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TRANSACTIONS

OF THE

AMERICAN CLIMATOLOGICAL ASSOCIATION.

SEPTEMBER, 1888.

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TRANSACTIONS

OF THE

~~FIFTH ANNUAL MEETING~~

OF THE

AMERICAN CLIMATOLOGICAL ASSOCIATION

HELD IN WASHINGTON, D. C.,

SEPTEMBER 18, 19, 20, 1888.

PHILADELPHIA:
PRINTED FOR THE ASSOCIATION.
1888.

DORNAN, PRINTER,
N. W. CORNER SEVENTH AND ARCH STREETS,
PHILADELPHIA.

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F. H. BOSWORTH, M.D., New York,

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R. G. CURTIN, M.D., Philadelphia.

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* Deceased.

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V. Y. BOWDITCH, M.D., Boston.

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R. G. CURTIN, M.D., Philadelphia,

F. I. KNIGHT, M.D., Boston.

Representative to Congress.

A. L. LOOMIS, M.D., New York.

---

* Deceased.

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LIST OF MEMBERS.

Abbott, Griffith E., Bryn Mawr, Pa.
Baker, Henry B., 726 Ottawa Street, Lansing, Mich.
Barger, D. E., El Paso de Robles, Cal.
Bell, A. N., 113 Fulton Street, New York.
Bosworth, F. H., 26 West Forty-sixth Street, New York.
Bowditch, V. Y., 113 Boylston Street, Boston, Mass.
Brooks, Leroy J., Norwich, N. Y.
Bruen, E. T., 1531 Chestnut Street, Philadelphia.
Butler, G. R., 402 Franklin Avenue, Brooklyn, N. Y.
Cabell, J. L., University of Virginia, Va.
Cammann, D. M., 19 East Thirty-third Street, New York.
Chapman, S. H., New Haven, Conn.
Coan, F. M., New York.
Cohen, J. Solis, 1431 Walnut Street, Philadelphia.
Curtin, R. G., 22 South Eighteenth Street, Philadelphia.
Daly, William H., 71 Sixth Avenue, Pittsburg, Pa.
Dana, C. L., 50 West Forty-sixth Street, New York.
Dennison, Charles, Fourteenth and Champa Streets, Denver, Col.
Didama, H. D., 112 South Salina Street, Syracuse, N. Y.
Donaldson, Frank, Jr., 108 Park Avenue, Baltimore, Md.
Donaldson, Frank, Sr., 108 Park Avenue, Baltimore, Md.
Dougan, David H., 322 Stout Street, Denver, Col.
Eskridge, J. T., Barth Block, Denver, Col.
Fisk, S. A., 809 16th Street, Denver, Col.
Ford, Willis, E., 266 Genesee Street, Utica, N. Y.
French, T. R., 469 Clinton Avenue, Brooklyn, N. Y.
Garland, G. M., Hotel Aubrey, Boston, Mass.
Garnett, Algernon S., Hot Springs, Ark.
Geddings, W. H., Aiken, S. C.
Gihon, A. L., U. S. N., Mare Island Navy Yard.

Glasgow, W. C., 2847 Washington Avenue, St. Louis, Mo.
Guitéras, John, Charleston, S. C.
Henry, F. P., 721 Pine Street, Philadelphia.
Hooper, Franklin H., 59 Marlborough Street, Boston, Mass.
Hopkins, T. S., Thomasville, Ga.
Hurd, E. P., Newburyport, Mass.
Ingals, E. Fletcher, 64 State Street, Chicago, Ill.
Inglis, David, 21 State Street, Detroit, Mich.
Jarvis, W. C., 25 East Thirty-first Street, New York.
Jayne, W. A., Georgetown, Col.
Johnson, H. A., 4 Sixteenth Street, Chicago, Ill.
Johnston, W. W., 1401 H. Street, N. W., Washington, D. C.
Jones, Talbot, 326 Wabasha Street, St. Paul, Minn.
Keating, John M., 1504 Walnut Street, Philadelphia.
Kenworthy, C. Y., Jacksonville, Fla.
Knight, F. I., 131 Boylston Street, Boston, Mass.
Kretzschmar, P. H., 402 Washington Avenue, Brooklyn, N. Y.
Langmaid, S. W., 129 Boylston Street, Boston, Mass.
Latimer, Thomas S., 1213 Eutaw Place, Baltimore, Md.
Leaming, James R., 18 West Thirty-eighth Street, New York.
Levick, James J., 1200 Arch Street, Philadelphia.
Linn, G. Wilds, Los Angeles, Cal.
Longwell, R. M., Santa Fé, N. M.
Loomis, A. L., 31 West Thirty-fourth Street, New York.
Matthews, Washington, Surgeon-General's Office, U. S. A.
Mays, Thomas J., 1829 Spruce Street, Philadelphia.
McDougal, W. D., San Jose, Cal.
Morgan, E. C., 918 E. Street, N. W., Washington, D. C.
Musser, John H., 3705 Powelton Avenue, Philadelphia.
Nunn, Richard J., 119 York Street, Savannah, Ga.
Orme, H. S., Box 1045, Los Angeles, Cal.
Otis, E. O., 62 Chestnut Street, Boston, Mass.
Page, R. C. M., 31 West Thirty-third Street, New York.
Parrish, Joseph, Burlington, N. J.
Peale, A. C., U. S. Geological Survey, Washington, D. C.
Pepper, William, 1811 Spruce Street, Philadelphia.
Platt. J. H., 450 Clinton Avenue, Brooklyn, N. Y.
Platt, Walter, 165 Park Avenue, Baltimore, Md.

Reed, R. Harvey, Mansfield, O.
Reed, Boardman, Atlantic City, N. J.
Rice, C. C., 115 East Eighteenth Street, New York.
Robinson, Beverley, 37 West Thirty-fifth Street, New York.
Rohe, George H., 147 Mulberry Street, Baltimore, Md.
Roosa, D. B. St. John, 20 East Thirtieth Street, New York.
Schauffler, E. W., 1221 Washington Street, Kansas City, Mo.
Seiler, Carl, 1346 Spruce Street, Philadelphia.
Shattuck, F. C., 135 Marlborough Street, Boston, Mass.
Shirmer, G. P., 359 West Forty-second Street, New York.
Shurly, E. L., 25 Washington Avenue, Detroit, Mich.
Smith, A. H., 22 East Forty-second Street, New York.
Smith, Frank F., St. Augustine, Fla.
Solly, S. E., Colorado Springs. Col.
Thomas, J. Carey, 317 Madison Avenue, Baltimore, Md.
Trudeau, E. L., Saranac Lake, N. Y.
Tyndale, J. H., 38 East Tenth Street, New York.
Van Bibber, W. C., 47 Franklin Street, Baltimore, Md.
Walker, J. B., 1617 Green Street, Philadelphia.
Ward, Samuel B., 135 North Pearl Street, Albany, N. Y.
Weber, Leonard, 25 West Forty-sixth Street, N. Y.
Westbrook, B. F., 174 Clinton Street, Brooklyn, N. Y.
Whittaker, James T., 100 West Eighth Street, Cincinnati, O.
Widney, J. P., Los Angeles, Cal.
Williams, G. A., Sharon Springs, N. Y.
Williams, H. F., 450 Classon Avenue, Brooklyn, N. Y.
Wilson, J. C., 1437 Walnut Street, Philadelphia.

MINUTES.

THE fifth annual meeting of the American Climatological Association was held in Washington, in connection with the Congress of American Physicians and Surgeons, in the hall of the new Grand Army Building, September 18, 19, and 20, 1888. There were fifty-three members in attendance. The President, Dr. Alfred L. Loomis, occupied the chair during the several sessions.

Dr. A. Earnest Sansom, of London, England, was present as an invited guest of the Association. Letters of regret were read from Dr. Korosi, of Budapest; Drs. Pietra Santa and Trauman, of Paris; and Dr. Ollendorff, of Berlin.

During the several sessions the papers which appear in this volume were read, some of them eliciting much discussion.[1]

At the business meeting, held at 2 P. M., Tuesday, September 20th, the President, Dr. Loomis, occupied the chair.

The minutes of the last business meeting were read and adopted.

On recommendation of Council the following new members were elected:

Dr. John Guitéras, Charleston, S. C.
Dr. W. A. Jayne, Georgetown, Col.
Dr. E. O. Otis, Boston, Mass.
Dr. Richard J. Nunn, Savannah, Ga.
Dr. F. M. Coan, New York.
Dr. Joseph Parrish, Burlington, N. J.
Dr. Leroy J. Brooks, Norwich, N. Y.
Dr. George H. Rohé, Baltimore, Md.
Dr. Griffith E. Abbott, Bryn Mawr, Pa.

The following members were dropped from the list, by recommendation of Council, in accordance with the constitution: Drs. Edward Bradley, M. F. Coomes, D. N. Kinsman, and H. V. M. Miller.

Remarks were made by the President on the death, since the last meeting, of Dr. A. Y. P. Garnett, of Washington, Vice-President of the Association at the time of his death; Dr. Thomas F. Rochester, of Buffalo, N. Y.; and Dr. A. B. Palmer, of Ann Arbor, Mich.

The President appointed Dr. Shurly to prepare a brief memorial of Dr. Palmer, Dr. Johnston of Dr. Garnett, and Dr. Ford of Dr. Rochester.

[1] Papers were also read from Dr. Wm. Pepper and Dr. C. C. Rice, which do not appear, as they were not received at time of going to press.—J. B. W.

The recommendation of the Council was agreed to, that the Association publish its own volume of *Transactions;* that the authors of papers shall each have the privilege of arranging for the journalistic publication of his own paper, and that the dues for the year shall be five dollars.

The bill of D. Appleton & Co. was referred to the following committee with power to act, Drs. Bosworth, A. H. Smith, and Walker.

The Treasurer's report was presented and audited, showing a balance in the Treasurer's hands of $32.81.

The Committee on Nominations, consisting of Drs. Curtin, Bosworth, and Solly, presented the following report, which was adopted:

President.—Dr. V. Y. Bowditch.

Vice-Presidents.—Dr. J. R. Leaming. Dr. E. T. Bruen.

Secretary and Treasurer.—Dr. J. B. Walker.

Council.—Dr. F. I. Knight.

Representative to the Congress.—Dr. A. L. Loomis.

On motion, the thanks of the Association were tendered to Dr. Bosworth for the success of the banquet.

It was, on motion, suggested to the Council that the next meeting be held in June, prior to the meeting of the American Medical Association, at Newport.

An invitation was presented by Dr. Solly to hold a session of the Association in Colorado, which was favorably accepted with thanks.

On motion of Dr. Bruen, the following was adopted: In future, when candidates are recommended to the Council, their names shall be accompanied by testimonials as to their general professional standing, and also with a list of publications on medical subjects.

On motion, the thanks of the Association were tendered Dr. Loomis for his efforts which made the present meeting of the Association so marked a success.

On motion of Dr. F. F. Smith, the following resolution was passed, and directed to be forwarded by the Secretary to Drs. Guitéras and Kenworthy:

WHEREAS, Our colleagues, Drs. Guitéras and Kenworthy, together with other honored members of our profession, are prevented from attendance at the present session by reason of their earnest efforts in combating the dreaded scourge at Jacksonville, Florida;

Resolved, That the Climatological Association sends to these men heartiest encouragement in their noble work, and earnest sympathy in their perils.

The banquet, which was held at Wormley's under the direction of Dr. Bosworth, Chairman of the Entertainment Committee, was a great success. Besides a full representation of our membership, there were present several distinguished guests, including Sir Spencer Wells, Sir Wm. MacCormac, Drs. A. Earnest Sansom, Thomas Annandale, Victor Horsley, David Ferrier, Arthur E. Durham, Frederick S. Eve.

J. B. WALKER,
Secretary.

THE PRESIDENT'S ADDRESS.

THE CLIMATE AND ENVIRONMENT BEST SUITED TO OLD AGE IN HEALTH AND DISEASE.

By A. L. LOOMIS, M.D., LL.D.,
OF NEW YORK.

Again the pleasant duty devolves upon me of welcoming you to an Annual Meeting of the American Climatological Association. Our fifth anniversary finds us a strong, well-organized, working body. Our records for the past four years show much good work done, and the programme for our present meeting is a guarantee for the future.

Three years ago, under similar circumstances, it was my privilege to say that this Association was organized that representative medical men from different sections might come together and, from their combined views and experiences, endeavor to determine the therapeutic value of the various localities which were claimed to have the power of arresting or curing chronic diseases of the respiratory and vascular organs; and I then expressed the hope that in the near future it would be a place where good workers could meet on a common ground with no medical politics or ethics (except such as one scientific worker is always willing to accord to his fellows), and there discuss in a scientific spirit those questions in etiology and therapeutics which are now engaging so largely the mind of the profession.

My hopes and prophecies have been more than realized, for our Association has not only made a scientific record for itself, but it has stimulated the profession in this country to harmonious work in the important field which we occupy, and has given such a prominence to climatology and hydrology in this country that our springs and health resorts are being placed on a more intelligent and scientific basis, so that English and French physicians are already sending their phthi-

sical and rheumatic patients to those American resorts which have received the sanction of this Association.

The fact that the subjects for investigation and experimentation, as well as the clinical studies which come within the scope of our labors, are becoming more and more important each year, and in all parts of the world are engaging the attention of some of our best medical workers, should stimulate this Association to a still higher standard of work.

With these few words of congratulation as an introduction to that which is before us, I will invite your attention to some thoughts connected with the climatology of age.

In studying the therapeutics of climate, and its effects upon diseased processes, one soon realizes that *age* is a factor which enters very largely into the climatic problems which we are endeavoring to solve—much has been written on the climates best suited to the management of different diseases, but the literature of *the climate and environment best suited to old age in health and disease* is meagre and conflicting. I have thought that it might not be without interest, if I should at this time give you some of the results of my experience and observations on this subject.

The life of man is naturally divided into four periods—infancy, youth, manhood, and old age; each period has its mental and physical characteristics, each its diseases, and each its therapeutics. There are conditions of environment and climate which not only are especially adapted to the development and vigor of each, but which influence largely the immunity from those diseases liable to occur at these different periods, often arresting or curing them after their development.

Most men begin to show signs of decay between fifty and fifty-five, while the favored few retain the vigor of manhood at seventy. Original conformations, heredity, habits of life, climate, anxieties, and temperament, unquestionably influence very greatly the commencing period of old age. Some men are old at forty, while others are young at seventy.

There are certain physiological and anatomical characteristics of old age, which especially interest us in the study of those conditions which are best suited to the fuller development and prolongation of life. The more prominent of these are: defective secretions and excretions, imperfect metabolism, feeble respiration, which interfere with complete oxidation, the excretory organs being more or less weakened withdraw from the body less perfectly the results of tissue metamorphosed. The nutritive functions, digestion and assimilation, are imper-

fectly performed. The arterial changes give a feebleness to cell nutrition which shows itself in the visible signs of advancing age. "The bones, the cartilages, the membranes, the flesh, the skin, and every fibre of the body becomes more solid and dry." But long after the decay of corporeal vigor, the understanding and the higher powers of the mind preserve their energy and precision.

It has been said that no sooner does man arrive at his full maturity than he begins to decline. This may be true of his animal life, but not of his intellectual. It does not seem consistent with the design of the Creator that all growth in man should cease with the attainment of his maturity. It is evident that his intellectual powers do not attain their highest development with the completion of his body growth; for we often find that those qualities by which "he rules the world, as reason and judgment," are most active after his body decline has begun. Some of the most brilliant and powerful productions in literature, science, and art have been the work of old age. Disraeli claims that the age of three score and ten is a most powerful one for writing.

There have been many striking examples, which prove how often the mind resists the body decay, and that the age of the physical organism does not necessarily enfeeble the mental powers. We can but believe that an intelligent care of the body, after it has reached its period of maturity with healthful exercise of the mental faculties, would make old age, not a period of decline, but a period of mental power and vigor. One has said "that among men of genius there is no old age." I would, therefore, make as strong requisites in the conditions which shall prolong and render healthful old age, a climate and environment which shall favor and tend to stimulate the mental activities.

To one studying the physiology of old age, it becomes apparent that the gradual and progressive impairment of the functions of organic life and the anatomical changes which precede or accompany their failing activity, can only be retarded by furnishing "to each organ, or each system of organs, their appropriate and natural stimulus without undue excitement or depression." There is unquestionably a hygiene of old age, which, if carefully studied and intelligently observed, would prolong its physical vigor and mental power. I have the opportunity of daily watching and studying one who has reached the ninety-fifth year; all her physical and mental powers retain their activity, her pulse has the characteristics of youth, her skin is as fair and soft as that of a girl of eighteen; in fact, the changes of old age, as usually met with in persons from seventy to eighty, have not taken place in her.

This case, as well as others of great age that have come under my observation, have taught me that the absence of senile change is the chief reason of their attaining their age, and have convinced me that if the hygienic laws of age were more carefully studied and observed, not only would greater age be reached, but they would be far more vigorous and useful.

I believe that the progressive degenerative changes in structure and failure in functional activities may so adapt themselves to each other as to produce an old age which may be as healthy as mature life. One of the most important of these hygienic laws is that the brain shall be stimulated by a pleasurable employment of its faculties, care being taken that it shall not be enfeebled by prolonged and continuous labor, this, together with healthful exercise, has a salutary influence on the entire system, while idleness and listlessness lead to senile atrophy of both mind and body. It is most essential also that the diet shall be simple and nutritious, as moderation in eating and drinking is indicated by the diminished cavity of the stomach, its reduced muscular power, and its declining nervous energy. So long as it can be accomplished without fatigue, exercise in the open air is another condition which promotes longevity, for it is evident that the perfect performance of respiration is stimulated by moderate exercise in a pure atmosphere and insures the highest state of oxidation, which is important to the healthful nutrition of the aged.

There is perhaps nothing that has a more prejudicial effect upon the aged than cold; their greatly diminished power of generating heat and of preserving it renders it necessary for their greater activity that they should live in a more equable climate, in localities that are sheltered from the north and east winds. Dr. Farr, in the *Third Annual Report of the Registrar-General of England*, states "that the rate of mortality rises in the aged, as the mean temperature falls. When the mean temperature of day and night falls a degree or two below 32° F., the rate of mortality immediately rises, and the effects of the low temperature go on accumulating and continue to be felt for thirty or forty days after the extremes of cold have been passed. I have noticed that the extremes of heat seem to be as hurtful to the aged as extremes of cold, and should be equally avoided."

Another essential to healthy old age is personal cleanliness. The skin which becomes unfitted for carrying off effete matters from the system, should have its activities stimulated by frequent warm alkaline baths followed by frictions to the surface.

The ancients showed great familiarity with the principles of hygiene

of old age. Cicero, in his "Senectute," says that we must make a stand against old age, and its faults must be atoned for by activity. We must fight against disease, and in like manner against old age. Regard must be paid to everything healthful. Moderate exercise must be adopted, so much of meat and drink must be taken, that the strength may be recruited and not oppressed. For, indeed, must the body alone be supported, but the mind and soul much more, for unless we drop oil on them as a lamp they are extinguished by old age. Our bodies, indeed, by weariness and exercise, become oppressed, but our minds are rendered buoyant by exercise.

With these thoughts before us in seeking climates and environments suited to the development and prolongation of old age, we naturally reach the following conclusions:

First. That healthy old age thrives best and is most vigorous when it can be passed in moderately warm climates. To accomplish this, a change of residence once or twice a year becomes a necessity. For some reason which I am sure is not based on experience or observation, it has come to be a common belief that old people should pass their last days in one locality, that they are so wedded to their homes and surroundings that any change affects them unfavorably; so prevalent is this opinion, even among medical men, that the usual professional advice is, that it is better that the aged should be made comfortable in their own homes however anti-hygienic they may be, than that they should change their residences as the seasons change. This, I am confident, is a very great mistake. I have found that old people not only bear changes well, but if such changes are judiciously made, they are not only invigorated by them, but that change of air and scene stimulates them to greater mental vigor and physical power. It is an established fact that change gives fresh impulse to mature life, and my experience teaches me that the same holds good with the aged.

Second. The localities best suited to the development of healthy old age are those which invite to an out-of-door life with surroundings and associations such as shall stimulate to mental and physical activity free from excitement, for it is to be remembered that the aged live more within themselves and are consequently annoyed and fatigued by excitement.

An old man that has the spirit of a Walton within him, who can spend most of his hours from sunrise to sunset with his rod in a pure air, grows strong and young, he hardly knows how or why. Paint to yourself the picture of such a one by some quiet stream angling for the wary trout, there is nothing to disturb his mental poise, and the

pleasurable excitement of the educated and enthusiastic fisherman is a stimulus to his mental and physical vigor, such as cannot be found elsewhere in the wide world. The botanist may find his new life in the flowers and plants that are not familiar to him in his old haunts. Or an Agassiz may find his inspiration as he revels in a new world of marine life.

Third. The localities suited to healthful development of age must furnish an abundance and variety of well-cooked food, the comforts and, if possible, the luxuries of life must be within easy reach, for if there is any one period of life more than another in which comforts and luxuries are essential to his healthfulness, it is that of old age. For what ought men in their activities to strive for more than comfortable sunset? As I have already stated, the food of the aged must be simple and nutritious, and, above all, well cooked. If you send a toothless old man to a second-rate hotel, even in the garden of Eden, his muscles will grow more flabby, his step more tottering; his mind will fail to be stimulated by the glories of nature which surround him, and he will languish and die for the good table and comfortable bed which he has left in his own home.

These, gentlemen, are a few of the conditions of environment which are necessary to the development of a healthy and vigorous old age, and it seems to me in this period of progress, it is not unworthy of scientific workers in our profession to study and make themselves familiar with those conditions and requests which shall tend to give us more vigorous and useful aged ones, and the few that astonish us by their mental power and ability to do good work long after the period of maturity has been passed, shall become the many.

As maturity passes almost insensibly into the period of decline, so the diseases of the early period of old age resemble very closely those of maturity. Dyspepsia, arthritic affections, and renal diseases, are then frequent. Later, obstruction to the venous circulation and the rigidity of the arteries lead to local hyperæmia and extravasation, which cause all inflammatory diseases to assume a subacute or chronic type, so that in estimating the therapeutic value of climate and environment in senile diseases, we are led to consider them from two standpoints:

First. Those diseases which may occur during other periods of life, but when they occur during the period of sensility present special characteristics.

Second. Those diseases which arise partially or entirely from changes in the economy which have taken place as the result of age.

In the last class may be included those structural changes which sooner or later reach such a point of development that the physiological and pathological states become blended by an imperceptible transition, and can no longer be sharply distinguished. It is simply a process of atrophy, the cellular elements of the parenchyma, the muscular and, perhaps, the nervous elements, progressively diminish in volume, but without presenting any essential modifications in structure. The connective tissue, however, does not participate in the same degree in this mode of slow destruction. It often predominates over the other tissue elements. During the period in which these changes are taking place, the body is especially susceptible to influences which lead to the development of diseases which are characteristic of this period of life, and which largely depend on the defective nutrition of the tissue elements.

That all chronic pulmonary diseases in the aged are greatly influenced by atmospheric conditions is taught by every day's experience. There are, however, certain anatomical and physiological differences in the respiratory organs of the aged which must be considered in determining the locality to which we will send the old man with bronchitis, emphysema, or phthisis. The rarefied condition of their lungs, the dilatation and diminished elasticity of their air-cells, and the obstruction of a large number of their pulmonary capillary vessels, accompanied, as it is, with the diffusion of the carbonaceous matter throughout their substance, modify very greatly the pathological changes which occur in them; besides, as years multiply, the volume of the vital capacity diminishes at the rate of one and a half cubic inches with each year, and the frequency, as well as depth and force, of the respiratory acts much less than in middle life, causing a greater preponderance of venous blood in the lungs than at any other period. It is evident that, on account of these changes, the climatic conditions and environment which would act therapeutically in pulmonary disease in the young, would not be suited to the aged—certainly, from a physiological standpoint, the rarefied atmosphere of high altitudes is not suited to the aged suffering with pulmonary diseases; too dense an atmosphere is equally injurious, nor do their cardiac and vascular conditions allow such changes to be safely made.

It is never safe for an aged person with chronic bronchial catarrh to pass quickly from a very dry to a very moist atmosphere. My clinical experience has given me many examples of the injurious effects of such changes in this class of cases, as well as the ill effects of high altitudes on the vascular system of the aged. The localities

which I have found best suited to old persons suffering with chronic bronchial catarrh and pulmonary emphysema, from December to April, is Nassau, the Bermudas, and Monterey. In July and August they do well at Shelter Island, and at Newport or Cape May; all of this class of cases that I have sent to the mountains have done badly, except a few that were complicated by hereditary asthma of long standing.

The phthisis of *old age* is generally of the fibroid variety, slow in its development, and never entirely recovered from; but its progress may be delayed and its distressing symptoms very much alleviated by an out-of-door life in a warm, moderately dry atmosphere. The locality of all others in which this class has been the most benefited during the winter months is on the Gulf coast of Florida. During the early spring, Thomasville, Ga., and Aiken, S. C., are places at which they can spend two or three months with benefit on their way north for the summer. During the summer months I have found that the seacoast off Cape Cod and Narragansett furnishes atmospheric and hygienic conditions which are especially adapted to a large class of old persons suffering with phthisis. I have frequently found that, after a summer spent in these regions, the activity of the phthisical processes was arrested, and that often those in whom the disease was quite far advanced made a remarkable gain in flesh and strength.

I have one patient, a gentleman now seventy-six, who has been under my observation for nine years with advanced phthisis, who had three homes—one in Orange County, Florida, one in Columbia, South Carolina, and one in Newport, Rhode Island; he divides the year between them spending his winters in Florida, his springs in Columbia, and his summers in Newport, and maintains a fair degree of strength and vigor; but for these changes, and the great care which he exercises in diet and an out-of-door life he long since must have succumbed to his disease.

In connection with the climatic treatment of the pulmonary diseases of the aged, I wish to say a word in regard to change of climate as a prophylaxis against their development. Physicians, as well as patients, are too apt to think only of the diseases that already exist, and lose sight of those which may threaten. While we are usually consulted for the relief of present difficulties, and not as to how possible ills may be averted, still, in our capacity as guardians of health, it seems to me that the time has come when we should impress upon the public mind the importance of prophylaxis, and teach those under our immediate supervision that after sixty a failure to recognize the changed

condition of their vital powers, and a continuance in the business habits of earlier life, after this period, are often no better than suicide.

Not a winter passes that I do not see cases exemplifying this point. When one who in early life has suffered from repeated attacks of severe bronchitis, or, it may be, has passed safely through a pneumonia or pleurisy or barely escaped a phthisis, finds himself in sight of three score and ten, he should be taught that, from a business as well as a physiological standpoint, he should so arrange his affairs as to avoid those months in our northern climate in which pneumonia and other acute pulmonary affections have their harvest among the aged.

During the past winter one of the most important and influential men in the business circles of New York, who barely escaped phthisis as a young man, was warned by his physician that at sixty-five he could not safely risk the vigor of a northern winter, and was urged to spend it on an island in the South where he owned a beautiful residence, but he plead the importance of a new business venture, which one of forty ought not to have undertaken single-handed, and laughed at the warning. In February after a hard day's work, he became chilled on his way home, and in three days added another to the list of business suicides.

In a country like ours, which offers so many delightful winter homes which are closely connected with our great business centres, there is no excuse for men of means neglecting these provisions of common prudence.

Physicians who have passed sixty years, especially if their previous history indicates a strong liability to pulmonary disease, ought also to remember that a doctor above ground can accomplish more in nine months of the year than he can below in twelve.

Very few old persons escape arthritic disease in one or other of its many forms. Charcot says that "rheumatism and gout are 'par excellence' the diseases of old age, and that the pain and inconveniences which they occasion interfere very greatly with their activities, and thus tend to shorten the duration of life." There is, perhaps, no class of diseases which are more markedly influenced by atmospheric conditions. It is by his gouty twinges that the old man so accurately predicts the coming storm, and the question is constantly coming to us from the aged sufferers, Where shall I go to escape my rheumatism? Certainly they must avoid cold, damp sea-places, as well as the mountains. I would advise that they should spend the winter months below the frost line in Florida, or in Southern California. I have yet to send an old person with gout or rheumatism to either of these locali-

ties to spend the winter who has not been benefited by the change. So soon as the comforts and luxuries of life can be obtained by invalids in these regions, I am quite sure they will become the winter homes of the old who are the subjects of arthritic diseases; chronic vesical catarrhs, independent or connected with prostatic enlargement, so common in the aged, is as much influenced by atmospheric conditions as are bronchial catarrhs, and occurring as they do in gouty or rheumatic subjects, usually obtain benefit in the same localities that are suited to arthritic subjects.

This class of cases, however, are exceedingly obstinate; if there is anything that shows more clearly than another their intractable nature, it is the long list of remedies which have been employed in their treatment.

I have long since abandoned the local measures usually resorted to in their management, and have relied almost exclusively upon diet and climate. My experience has shown that they are always aggravated in damp, cold localities, especially those that are subject to sudden and extreme atmospheric changes, while they are greatly improved and sometimes entirely relieved by a residence in a warm sea climate.

I have found the Bermudas and Nassau best suited to this class of cases. I recall a very obstinate case of a gentleman seventy-two years of age, who had suffered constantly for four years with an aggravated form of chronic cystitis, and had been subjected to various plans of treatment, both local and constitutional, without relief, who entirely recovered after he had taken up his residence in Monterey.

The localities which I have named as best suited to the aged in health and disease, are those with which I am personally familiar; I have not referred to those outside the boundaries of our own country, for my experience has convinced me that it is seldom wise for an old person to take the risks of a long sea-vogage. There are undoubtedly many other localities equally as desirable as those which I have named, but my personal experience is not sufficient for me to recommend them.

If the few suggestions which I have made shall have so interested the members of this Association, that a more careful and extended study of the hygiene, and a more intelligent care of the aged in health and disease, shall gain a more prominent place in the work of our profession, I shall be satisfied and feel that I have added my mite to the relief and prolongation of the most interesting period of human life.

A STUDY OF THE CLIMATE OF COLORADO AS APPLIED TO THE ARREST AND CURE OF PULMONARY DISEASE.

By SAMUEL A. FISK, A.M., M.D.,
OF DENVER, COLORADO.

In the presentation of this subject I shall not attempt to argue the question of the advantages of a high altitude over those of a low, nor to extol the virtues of a cool climate as opposed to a warm, nor yet to praise dryness as contrasted with moisture. I shall accept the fact that the climate of Colorado is characterized by elevation and dryness, and that it is essentially a cool climate, and on that basis it will be my endeavor to describe its several qualities faithfully and impartially; to be eyes and ears for the Convention, to be the observer in its stead, and, in so far as I am able, not only to state its good qualities, but its bad, so that I may be free from the charge, so often laid at our door, of being *ex-parte* in our writings and of at least suppressing the truth even if we make no misstatements.

In selecting this subject for presentation, I am aware that I may lay myself open to the charge of offering nothing new; but so convinced am I of the merits of the Colorado climate, so many cures have I seen wrought in it, during an eight years' residence, and so efficacious do I believe it to be in the arrest or cure of pulmonary disease—in many of its forms—that I cannot refrain from adding my voice to those who are proclaiming its virtues, until, by sounding its praises so long and so loud, we may compel the world to hear.

"What do we mean by climate?" is the very pertinent question which Dr. Burney Yeo asks at the opening of his work on that subject; and he answers it by saying: "We generally mean by a question of this kind that we desire to know how the natural conditions and surroundings of a particular place affect the life and well-being of its human inhabitants." These conditions are the nature of its atmosphere, or aërial cloak, and the nature of its surface.

Let me speak of the latter condition first. The State of Colorado embraces a territory between seven meridians east and west, and four parallels north and south—that is, it is 380 miles long and 280 miles broad, having an area of 103,925 square miles, a superficies which is considerably more than double that of the State of New York, thirteen times that of the State of Massachusetts, and twice that of England. The southern border of this tract corresponds in its distance from the equator to Old Point Comfort, while its northern border equals Yonkers on the Hudson. Its most densely inhabited portion, however, corresponds very nearly to the space between Fredericksburg on the south and Philadelphia on the north, while its principal city, Denver, has the latitude of Baltimore in this country, or of Lisbon in the old world.

It is evident that in speaking of the climate of so vast a tract of country, one can only mention the prevailing characteristics, and that considerable allowance must be made for deviations from that which is accepted as the standard. Through the centre of Colorado, running north and south, the Rocky Mountain range extends, its water-shed on the east emptying into the Mississippi River, by means of two small tributaries, the south branch of the South Platte in the north and the Arkansas in the south, streams which can be easily forded, and in summer time are so shallow, especially the Platte, that one can wade them without wetting the knee. The flow from the western water-shed is into the Pacific, through the Colorado River, while to the south a small portion of the State drains into the Gulf of Mexico by means of the Rio Grande.

I have spoken of these points because I wish to emphasize the fact that the drainage of the melting snow, from the 280, or over, miles of mountain-sides, whose waters flow to the east, is mostly subterranean, and that the surface is dry, affording a very slight amount of water. This factor is of most importance as contributing to the dryness of the climate, a condition which is due in a large measure to the distance which separates the State from any large body of water. Within the portion of Colorado lying to the east of the mountains, that portion most frequented by invalids, there are no large bodies of water from which the air can take up moisture, and a distance of over 900 miles from the Gulf, the nearest large body of water, is an additional cause for the exceeding dryness of the air of this State. Atmospheric dryness, due largely to geographical position, is one characteristic then of the climate of Colorado. Of course, this condition is also affected by atmospheric pressure, elevation, and temperature; but in the main it is due, as I have said, to geographical position.

But of almost equal importance, as has been ably shown by the researches of Bowditch and Buchanan, is the question of soil dryness. Here, again, the conditions are most favorable. To the east of the mountains, the portion of the State most inhabited, the land falls in a gradual descent from an elevation of about 6000 feet at the foot-hills, to one of about 3500 feet at the eastern border of the State, some 190 miles distant. Its surface is well drained into the two rivers I have mentioned, whose waters come principally from the mountain sides, and, as a fact, most of these waters sink into the porous and thirsty soil to increase the subterranean flow, or to well up again as they near the mouth of the streams. Besides this natural drainage, favoring soil dryness, there are the additional features of a sandy and porous soil, which absorbs moisture rapidly, the absence of shade to retain it, and the further absence of precipitation to make it moist, as I shall have occasion to show further on in this paper.

Another property possessed by this climate due to the nature of its position is elevation. This varies from 3500 feet at the eastern border of the State, to 4500 feet at Pueblo, 5200 feet at Denver, 6000 feet at Colorado Springs, 7200 feet at Idaho Springs, 8000 feet at Georgetown, and 10,000 feet at Leadville. So that it is possible, within these limits, to give a patient any degree of elevation that may seem desirable.

Further than that, local configuration varies so that one can have his choice of open plain, or of mountain valley. He can have the winter on dry ground at Colorado Springs, Denver, and numerous other places; or he can enjoy what Dr. Franklin and others place such stress upon, in considering Davos Platz—that is, the solar radiation intensified by radiation from the snow in valley and on peak, such as occurs in narrow valleys amongst the mountains. The large area of the State admits of great variety of location, which can be taken advantage of by the invalid, and which our physicians are now studying and learning more closely. The common characteristics, due to surface and position, are, elevation, soil and atmospheric dryness, rarefied air, an absence of shade and a temperate clime, varied somewhat from the main characteristic by conditions induced by rarefaction of the air, absence of atmospheric moisture, and a sandy soil.

Let us turn now to a consideration of the atmospheric conditions prevalent in Colorado. Here, again, I shall give the prevalent and main characteristics, and I take the privilege of presenting those conditions that exist at Denver, for the reason that it is the centre of the State, as regards its population, and nearly so as regards its geographical position. It is the capital, the best known place in the State,

and, further, meteorological records have been kept in it for the last dozen years.

The facts that I shall now proceed to give, I have taken largely from these records; I shall refrain, however, from giving tables—because they are wearisome, and must refer you to writings on this subject.

"The chief conditions of the atmosphere," says Yeo, "that affect the climate of a place, are these: (1) its temperature; (2) its movements (winds); (3) its amount of aqueous vapor; (4) its electrical conditions; (5) its purity; and (6) its density or pressure."

Dr. Frankland, in his article,—"A Great American Winter Sanitarium for the American Continent," states as the qualities of climate existing at Davos Platz, which he regards as so desirable: (1) great elevation above sea-level; (2) a continuous and, during winter, permanent snow-covering; (3) a minimum of watery vapor in the air; (4) a clear sun; (5) a clear atmosphere, free from zymotic germs, dust, and fog; (6) a sheltered position favorable for receiving both the direct and reflected solar rays. These views are sanctioned by Hermann Weber, Lindsay, Yeo, Tucker Wise, and others. Some place emphasis upon the presence of ozone, but as so little is known positively about ozone and about electrical conditions of the atmosphere, I think that we may dispense with any consideration of them, simply expressing the belief that whatever advantages come from their presence are common to Colorado with other high altitude resorts.

Taking, then, the gauge of climate as set down by these eminent authorities, let me show to what extent they exist in Colorado, and how they are considered to be beneficial.

Elevation, or diminished atmospheric pressure, is presumed to induce a more rapid circulation, which may, in many cases, be beneficial by assisting the removal of the products of disease in the chest. On the other hand, in greatly enfeebled cases, it may so hasten metabolic change as to be highly injurious.

It also increases the number and the depth of the respirations, a condition of affairs which is assumed by many to be due to the fact that the diminished oxygen in the rarefied air causes a so-called "starvation of oxygen," which requires a hastening of the respirations to supply the deficiency—a theory which Dr. Hermann Weber pooh, poohs! and which seems but little susceptible of mathematical demonstration. The increase in the number of pulse beats and of the respirations, I think, tends to regulate itself after a residence in high altitudes. Authorities agree, however, that chest expansion does occur,

and this may be beneficial as calling into play unused, or but feebly used portions of the lung.

Beneke has shown that heat is lost from the self-same apparatus more slowly on the tops of mountains than at the seashore, a fact which Frankland emphasizes with reference to the sensation of cold, when he says, "The air, if still, feels warmer at an elevated station than in the lower and denser regions of the atmosphere, in consequence of the slower abstraction of heat from the body."

Hermann Weber speaks of the fact, that at elevated regions blood flows to the surface of the skin, that it thus becomes better nourished, that the internal organs become unloaded, and that the elimination of carbonic acid from the blood of the lungs is facilitated.

Whatever benefits come to the human economy from a residence at high altitude, and I have mentioned some that are presumed to accrue, they are to be gained by living in Colorado, where the elevation of the inhabited portion of the State ranges from 3500 to 10,000 feet.

Humidity.—This element is highly variable in mountain resorts; it depends on the character and direction of the prevailing wind and on the local configuration; the tendency, however, is toward dryness rather than humidity. I have already shown how the geographical position and configuration of the surface of Colorado tend to the production of atmospheric dryness; of course, the rarefaction of the air aids in the same direction. But now let me state the facts:

The average mean relative humidity for a series of years I have calculated to be only 45.8 per cent. of saturation, as against 69 per cent. in Jacksonville, Florida; 70.2 per cent. in New York; and 65.8 per cent. in Los Angeles, California. I have also shown, in a previous writing, that this mean is reduced to an average mean of 41.5 per cent. at noonday for the eight winter months of September to April inclusive, and that it not infrequently sinks to 25 per cent. of saturation; a condition that in Switzerland would endanger the production of the Föhn. If, instead of relative humidity, we speak of the absolute humidity—*i. e.*, the number of grains of vapor contained in a cubic foot of air, the showing is immensely in favor of Colorado, inasmuch as rare air at a given temperature will hold less moisture than a denser air at the same temperature. The mean absolute humidity for Denver for a series of years was only 1.81 grains of vapor, as against 5.38 grains at Jacksonville; 3.02 at New York; and 3.77 at Los Angeles.

All authors attest the value of dry air in the arrest or cure of pul-

monary disease, and the influence of moisture in its production. A patient in search of a dry air cannot do better anywhere in the United States than to come to Colorado.

SUNSHINE.—It is in this particular that the Colorado climate is particularly strong. Figures show that, according to signal service method of reckoning cloudy days, there are only 46 such in a year in Denver, as against 87 in Jacksonville; 109 in New York; and 51 in Los Angeles. This, however, takes into consideration the whole twenty-four hours. If we approach the subject in another way, with reference to the ability of a patient to be out-of-doors during the day-time, we may take as a gauge what occurred in the winter of 1884–85, considering the months of September to April inclusive, in which time I find that there were only 11 days, out of 242, which were cloudy all day long — that is, when the sun did not shine at all from 9 A. M. to 5 P. M.

Certainly a counting of three hundred and twenty days of clear or fair weather in a year, when the whole twenty-four hours is considered; or of two hundred and thirty-one days out of two hundred and forty-two days, taking the hours from 9 A. M. to 5 P. M., is a tremendous showing of the extent of sunshine that occurs in Colorado.

But this is not all. The principal resorts lying, as they do, on the edge of the plains and not being sheltered by mountains, enjoy a number of hours of sunshine a day such as few mountain resorts can boast. A comparison will make this clearer. Dr. Tucker Wise has stated that on the first day of January the number of hours between sunrise and sunset in the Alpine resorts are as follows:

	Hours.	Minutes.
Maloja	7	10
Wiesen	6	10
Pontresina	6	40
St. Moritz	5	5
Davos Platz	4	57
Andermatt	3	30

By way of comparison I introduce Denver, nine hours and seven minutes, or nearly twice that of the world-renowned Davos.

Not only does Denver enjoy so many more hours of sunshine, but there is the additional consideration that the sun is up, warming the air, a number of hours before the invalid gets out-of-doors, while at Davos and other Alpine resorts the sun and the invalid make their appearance together. The following figures of sunrise will show this:

Maloja, 9.35 A. M.; Wiesen, 10.35; Pontresina, 8.30; St. Moritz, 10; Davos Platz, 10.03; Andermatt, 11.45; Denver, 7.30, for the first day of January.

Knowing the warming influence of solar radiation, the part that these early hours of sunshine play in making the air comfortable for the invalid cannot be overestimated. It is like having a fire built in a cold room an hour or two before a patient arises, or having it lighted just as he tumbles out of bed.

One more influence of sunshine and I will then proceed to other topics. The mental influence, the cheer which bright sunshine, clear, warm air, and a dry soil give to a life out-of-doors, thereby *inviting* and not forcing the invalid to a drive, a walk, a ride, a game of tennis, and to all healthful out-of-door influences. I cannot lay too much stress upon this factor of Colorado sunshine—an important, if not the most important, feature of our climate. I would like to touch on it from the more poetic side, telling of the color it gives to daily life, but I must hasten to other considerations.

TEMPERATURE.—The question of the temperature of the Colorado climate is one of the most difficult to treat, because it involves a consideration of the difference between day and night, between the sun and the shade, between mountain and plain, between month and month. Broadly speaking, the days of the summer months are uncomfortably hot, in the cities, but even then the nights are cool, generally requiring that one be covered with a blanket, so as to be comfortable.

There is no denying the fact that Denver and even Colorado Springs were intolerably hot this past summer. Even admitting this, the advocates of this climate can respond that the invalid should go to the mountains, where in Extes Park, Manitou Park, Georgetown, Poncha Springs, Twin Lakes, and other places he can breathe the purest air and have comfort. But the main consideration is one of the winter months, say from September to April inclusive. Here, again, I must admit many of the adverse criticisms made in regard to our climate. One writer, hunting the records over, for years, accuses us of having a diurnal change of eighty degrees in twenty-four hours, and he was correct: such a variance does occur—occasionally.

The meteorological conditions producing this change involve so well known a principle that it scarcely seems worth while to discuss them. Land radiates heat more rapidly than water, it becomes heated and loses its heat much sooner than water; and a dry, sandy soil will do this more rapidly than a moist. Shade and vegetation hinder both

processes, so that the absence of shade favors both the heating and the cooling process. A rare, dry air favors the transmission of solar heat, by robbing it of but little of its intensity, and it also aids and abets terrestrial radiation.

These, then, are the conditions existing in Colorado, a dry, sandy soil; a lack of shade and vegetation; a rare, dry air. The result is a rapid warming up under the influence of the sun; a rapid cooling when that influence is removed. Hence we do have warm temperatures by day, and cool temperatures by night, and the difference does, at rare times, amount to eighty degrees. But, for the purposes of an invalid, the warmth and not the cold should be considered, because the latter comes at night when the invalid should be housed and can regulate the temperature, while the former is at mid-day when he is getting his exercise out-of-doors. A temperature of 62° at noon is of more importance to him than one of minus 18° at midnight. But Colorado climate is, in winter, a cool climate. The monthly mean for

January, 1886, at 1 P. M. was	27.3°
February, " " " "	48.0°
March, " " " "	41.1°
April, " " " "	52.3°
May, " " " "	74.3°
June, " " " "	75.1°
July, " " " "	85.2°
August, " " " "	81.5°
September, " " " "	72.0°
October, " " " "	64.2°
November, " " " "	41.3°
December, " " " "	45.5°

This is the temperature of the air at the time of day when an invalid is most likely to be out of doors. If these means seem too cold to the student of climate, I can only urge in extenuation: (1) To quote from Dr. Hermann Weber: "It is only a remnant of our old prejudice which can make us afraid of dry, calm, moderate cold;" or (2) as pointed out by Dr. Frankland, and as every person who has had experience knows, that "the air, if still, feels warmer at an elevated station than in the lower and denser regions of the atmosphere;" and (3) that the solar radiation must be taken into consideration, which transforms, to one in the sunshine, the air temperature from one of 27.3° F. at noon in January, to 92.5°; or the air temperature of 45.5°, in December, to the heat in the sun's rays of 100.2°.

No one, I think, need be apprehensive of cold days in Colorado,

unless he be so much impoverished in physical condition as to make him an unfit subject for our climate. In most cases the inhalation of dry, cold air stimulates the respiratory functions to greater activity, leading, as Dr. Weber asserts, to greater expansion of the lungs and thorax, to improvement of the appetite and nutrition, thus exercising a beneficial influence on the course of phthisis.

WINDS.—Statistics show that the average daily movement of the air in Denver is 145 miles as against 238 miles in Boston, 207 in New York, and 159 in Jacksonville; the data further prove that at 9 A. M. the average hourly velocity is 6.7 miles during the eight months, September to April inclusive, 8 miles at 1 P. M., and 8.6 miles at 5 P. M. Despite this low average, we are constantly accused of having high winds, and of the dust and sand storms being so disagreeable as to be detrimental to an invalid. With a view of meeting this criticism I collected data, awhile ago, which showed that in the year 1886 there were only twenty-three days in which there occurred a wind of eighteen miles or over, at two consecutive observations of the three 9 A. M. and 1 and 5 P. M., and that there were about an equal number of times when there was a wind of equal velocity at only one of these three observations. Now, a wind of eighteen miles velocity is not a high wind. It is less than double the average velocity of the air in Boston, and is not more than a stiff breeze.

We do have occasional high winds, and they occur more frequently in some places than in others, but we are not entitled to the reproach so frequently hurled at us, that the winds and dust storms spoil the climate. The truth is that, owing to the sandy character of the soil and the absence of snow covering, a wind of moderate velocity will lick up the dust and set it a flying, while a stronger wind, as of eighteen miles per hour, will set up what is called a dust storm. These are no more disagreeable than I have witnessed on Commonwealth Avenue, in Boston, many and many a time. From the nature of things they are more frequent in the narrow streets of Denver than in the open country, or in the health resorts, and are in no way to be ranked with the cyclones of Kansas, or even with the gentle and moderate breezes of the peaceful Connecticut Valley, which I have known to blow over bridges and tear up hundreds of elm-trees by the roots.

These dust storms are disagreeable, principally so in Denver, where the streets are the natural soil, which becomes dried by the ardent rays of the sun and pulverized by travel, so that they have to be constantly watered, even in January and February. But the frequency and violence of these storms have been very much overstated, and they do not

seriously impair the invalid's comfort, or keep him indoors much of the time.

Precipitation.—The average yearly fall of rain and snow (melted) is 14.77 inches as against 55.94 in Jacksonville; 49.47 in Boston; 42.7 in New York; and 18.97 in Los Angeles, and of these 14.77 inches the greater part falls in the spring and summer months. Snow does not lie upon the ground in winter, and when it falls it is rapidly licked up by the dry breezes or drunk up by the porous soil.

Drs. Frankland and Weber consider a snow covering in winter of advantage because it keeps down germs, and also because, by reflecting the sun's rays, it increases the solar radiation. The former reason may be a valid one, but is it not counterbalanced by the deleterious effects of the thaw and by the decomposition and decay that is then induced? Is it not also more than counterbalanced by the disadvantage that a heavy covering of snow and ice is to the invalid who wants to drive, ride, play tennis, walk, climb, and lead an out-of-door life from nine o'clock in the morning until five o'clock at night? We in Colorado think so, and we prefer free and untrammelled locomotion on dry soil, even though there may be a few germs afloat, to wet feet, cold, hampered exercise, thaw, and everything that must follow upon the existence of a deep snow covering.

As regards solar radiation, I have previously shown that while the mean average in the Maloja for November, December, January, and February was 103.75°, that in Denver it was 99.75° for the same time, a difference of four degrees in favor of snow covering, but not of material difference when one considers the actual temperature. If an invalid is not comfortably warm in a sun temperature of 99.75°, it is to be doubted very much whether 103.75° will warm his thinned blood.

Fogs.—Almost unknown. In the winter of 1884–85 there is not a record of a single fog from the 1st of September to the 1st of May.

Purity of the Air.—I have left a consideration of this factor to the very end, because I wish to bring out certain points in connection with it. Generally speaking, every one acknowledges the purity of mountain and of sea air. We are in the habit of saying that it contains more ozone—a factor of which we do not know much. Basing our ideas upon the investigations of Pasteur, Tyndall, and Miquel, we say it is aseptic, free from germs, and we place the limit of germ-life at elevations ranging from 5000 to 7000 feet. I wish to raise the question whether we are right in so doing, and whether this principle may not be varied by other influences, so that instead of being taught to believe that altitude, in itself, is a germicide, we shall not rather believe

with Hermann Weber, "That wherever a large number of human beings, especially invalids, congregate, there the purity of the air is likely to be impaired."

That there is germ-life in the air of Denver and of towns in Colorado I am assured. Urine decomposes nearly as readily in these places as in Boston, and if one wishes to be sure that the casts are not eaten up by the little vibrioles, he must make his microscopic investigation early, just as he would in the East. Moreover, I have seen dead cattle lying on dry ground in Colorado, at varying elevations, subject to the drying effect of the sun's rays, which would desiccate, shrink up, and fall to pieces; and I have seen other dead cattle, at equal elevations, lying where there was some moisture, from which a most noisome stench would emanate. Certainly we do have decomposition at all elevations in Colorado, and that means putrefaction, and, consequently, germ-life.

Where there is an absence of putrefaction in our climate, it seems to be due to the dryness of the air rather than to the absence of germ-life. But even admitting the presence of germs, it does not militate against the purity of the Colorado air, for whatever qualities belong to mountain air certainly can be found in the air of our Rocky Mountains, whose sides are studded with towns up to an elevation of 11,000 feet, and whose summits tower into the skies at 14,000 feet.

It has often been said that different animals seem to possess different degrees of sensitiveness to the rare air of mountainous regions, and that the cat cannot exist at great elevations. This assertion, with others, should be subject to modification, for I know of one cat that lived for ten years at an elevation of 11,000 feet, and in Leadville, 10,000 feet, they are not at all absent.

Résumé.—These, then, are the general characteristics of the Colorado climate: (1) elevation; (2) dry air; (3) a large amount of sunshine; (4) a warm sun temperature; (5) a somewhat variable temperature, cool, not cold, in winter, cold during a winter's night, but comfortable at mid-day; (6) a moderate motion of the air, with occasional high winds; (7) a small snow- and rain-fall; (8) the absence of fogs; (9) a pure air; (10) a dry, sandy, well-drained soil.

But, gentlemen, the simple narration of these climatic conditions in no way rounds out a just description of the arrest or cure of consumption as applied in the Colorado climate. It does not tell of the local conditions of the different resorts; of the out-of-door life; of the diet and exercise; of the home life; of ranch life; in fact, of the various local conditions and of the means adopted to aid recovery, many of them varying from those employed elsewhere.

A description of this side of the subject furnishes too large a field to be handled by me at the present time, and in their individual application to the various cases of consumption, they should be left entirely in the hands of a competent physician, residing in that climate. One feature cannot be too strongly emphasized as characteristic of the Colorado cure. It is an all-year-round resort and not simply a winter resort; and further, our State is an active, growing community, and there is plenty of room for the energies of the most active, when once a recovery is secured, so that a return to old methods and haunts is not to be recommended.

The State now claims a population of over 350,000 inhabitants. How many of these have come for reasons of health it would be difficult to say. Every town and every city has its large percentage of such people, who, in their own persons and in the energy of their lives, are the strongest testimony that can be given to the efficacy of the Colorado climate in the arrest and cure of pulmonary disease.

INVALIDS SUITED FOR TREATMENT AT COLORADO SPRINGS.

By S. EDWIN SOLLY, M.D.,
COLORADO SPRINGS.

In last year's *Transactions* of the Society is printed a sketch by me of the diurnal meteorology of this resort. I now propose to bring before you, after a brief reference to the climatic conditions, first, a summary of the consequent physiological effects, and then show what general results must necessarily ensue in certain pathological conditions presented to their influence. I will then proceed to give some of the results of my own experience; but as time and space are limited, I must reserve for another occasion the presentation of clinical records. The object of this paper is then not so much the recording of personal experience, as the offering of an epitome of the underlying principles, on which to form a basis for judging, each for themselves, whether such and such an invalid is suited for treatment at Colorado Springs.

The town of Colorado Springs containing a population of 10,000 people, spreads over an area of five to six square miles, is situated on a plateau about six miles from the base of Pike's Peak. It is sheltered by foot-hills, except to the southeast, where it lies open to the great plains, and stands at an altitude of 6022 feet, latitude 39, longitude 105. There is no large body of water nearer than the Gulf of Mexico, 800 miles away. The soil is of dry sand and gravel beneath a shallow layer of garden soil. There are no springs beneath the town site, the water being brought in pipes and ditches from a distance. The supply is excellent for the quality and quantity. There is a good sewerage system. The houses are far apart, with shade trees and gardens, growing only by irrigation. There are no manufactories.

The means for several years are as follows: Barometer, 24.06; relative humidity, 46; absolute humidity, 1.73. Annual rainfall, including melted snow, 15.87; mean temperature, 46.4°; prevailing winds, north and southeast. Number of clear days, 194; fair, 128; cloudy, 43.

The rain all falls between the 1st of April and the 1st of October, and very little snow falls in winter. As might be expected, as far as a rainy season occurs, it is just the reverse of what happens in California and upon the western side of the rockies, where the bulk of the precipitation falls through the winter half of the year.

The mean temperature is composed from the mean temperatures of warm days and cool nights, the contrast being very marked all the year round, but especially in the winter.

The prevailing wind is from the north and northwest during the hours of darkness; during daylight it shifts from north to south and back again through the eastern quarter; roughly speaking, the night wind is from the mountains, and the day winds from the plains. The total annual movement of wind is 70.912, which is less than any of the great cities, such as New York, Chicago, or San Francisco, and, in fact, than most parts of the continent, excepting Florida and the South, and the southern part of California.

These being the meteorological and climatic factors, we have as a result—a very dry, pure, rarefied air, brilliant, and almost constant sunshine, especially in winter, cool nights and cool shade. The average days being warm all the year round, the extremes of heat and cold in their effects being modified by the dryness. A constant movement of air, with less of high winds than in most of the frequented parts of the States. The conformation of the surrounding country breaks the force of storms and shields many of them from the town site, but leaves it open to the sunlight and free movement of air. A dry, well-drained soil, with scanty vegetation, pure water, absence of the frequent objections of cities, good supply of the comforts and luxuries of civilization, and plentiful and convenient means of access—such are briefly the climatic conditions.

The physiological effects of the climate agree in the main with the physiological effects of elevated climates in general, as described by Dr. Hermann Weber, in his article upon climatology in Ziemssen's *Handbook of Therapeutics*, and with whose conclusions I find the other authorities coincide; I will, therefore, quote in brief the physiological effects of elevated climate, as summed up by Dr. Weber:

THE SKIN is better nourished, strengthened, and rendered more active.

THE CIRCULATION.—The heart and contractile vessels of the vascular system are probably strengthened; the frequency of the contraction of the heart is certainly increased at the beginning of the stay, but returns to the usual number after a time; each separate con-

traction is strengthened, by which the strength of the circulation is increased.

Lungs: Respiration.—The number of respirations is increased at the beginning of the stay, but returns to the usual number after a time, and probably the depth of the inspiration is increased. The respiratory muscles are strengthened, and probably also the elastic vessels of the finest bronchial ramifications. The amount of blood in the lungs is increased.

Lungs: Excretions.—The amount of water separated from the lungs is usually increased, and the separation of carbonic acid rendered easier.

Appetite and Assimilation.—A transient or permanent increase of appetite and assimilation of nourishment occurs in most cases.

Nourishment.—The improved formation of blood and nourishment of the organs consequently ensues.

Nervous and Muscular Systems.—There is a greater energy of both of these systems.

Sleep is generally improved.

Change of Substance is probably increased.

I will now refer to some of the evidence in support of the foregoing conclusions that has been presented to my observations in this locality.

The skin. The complexions of persons coming to Colorado are changed as follows: Besides the tanning caused by the direct effect of the intense sunshine, the skin is reddened, as seen in all parts of the body, even in those not exposed to the sun, there being evidently a more vigorous circulation of oxygenated blood through the cutaneous vessels. The pink and white complexion is replaced by a general ruddiness and bronzing; the blue veins of the anæmic are less noticeable, and the muddy complexion of the bilious is cleared and made brighter. The truth of this is confirmed by pathological observations. All affections involving acute inflammation of the skin and its appendages are exhibited in intensity, as in erysipelas and poisoning from ivy and sumach; while chronic affections, such as acne, lupus, varicose ulcerations, etc., are generally quickly benefited and but rarely seen. The first effects of the climate often cause falling out of the hair, but continued residence usually brings it back. Of course, in dealing with the practical questions of the probable effect of the climate upon a given case of skin disease, as in all other diseases, not only has the direct climatic effect, notably through dryness, to be considered, but also the general influence. As cutaneous affections are more or less

seriously influenced or controlled through the nervous system, this is especially to be considered in such affections.

The circulation. It is a matter of universal observation in Colorado that the heart-beats are at first increased, and in those with whom the climate agrees, and in whom there is no pathological condition preventing it, the heart-beat will return in time to its usual rate, the time being longer or shorter, according to the general vigor and age of the individual. That one of the secondary effects is to make each cardiac contraction stronger is, I believe, true. The direct impression gained from observations by ear and finger on the relative strength of the contractions agrees with this. Pathological observation, however, is the best evidence. A considerable number of anæmic consumptives, especially when young, have a tendency more or less developed toward simple dilatation. Many cases, which gave no signs at sea-level, exhibit them on first coming to Colorado. Such cases, if permitted to exercise only with great care, generally gradually lose all symptoms of dilatation, and some, in time, shows signs of hypertrophic compensation, provided, of course, the cardiac muscle has not been too far stretched, or is not degenerated in tissue, so as to prevent its regaining its elasticity, and in whom general improvement of health occurs. The observations of Oertel confirm this view. Moderate dilatation in persons under thirty years, whom otherwise the climate benefits, is often improved if they will submit to very strict medical discipline, especially in the matter of exercise; but practically such cases can usually be treated successfully in other places with much less risk than they encounter at this elevation. Graduated gymnastic exercises and climbing steps and moderate hills can, I believe, be better used to strengthen carefully the cardiac muscle than putting them under the continuous strain that living at an altitude of 6000 feet involves. Where the dilatation is marked, the exercise at this elevation is necessarily so limited that the patient is apt to chafe under the restriction, and break it to his own detriment, or suffer in general health for want of sufficient exercise to promote appetite and nutrition.

It goes without saying that all cases in which there is fatty degeneration or otherwise of the heart, or in which there is evidence of grave valvular lesion without ample compensation, should not be exposed to the dangerous strain that the first effects of the climate involve. Cases are seen in Colorado who have passed through this period, and who, living a careful life, do comparatively well. No doubt, in such cases, it is because the secondary and chronic climatic effect is to equalize the blood pressure throughout the entire vascular system, and make

the circulation vigorous and complete. All the finest capillaries being well filled, the continued effect is to relieve strain at any one part, and to get rid of chronic local congestions. The most powerful proof of these foregoing statements being true is the fact that has been established by Archibald Smith, from his experience in the Andes, of a marked mitigation of the symptoms in cases of aortic aneurism, and this the observation of myself and my colleagues fully confirms. Nevertheless, in view of the great danger of permanent increase of the lesion or fatal results by slight excess of exercise during the early portion of the stay, or by sudden or violent exercise during any later period, it cannot be wise for physicians to recommend such cases to come to this elevation. Were the American patient like the German, less independent of, and more dependent upon, the judgment of his physician, this advice would doubtless admit of modification; but alas for the procuring of the best results of treatment, our patients have yet to learn that, in many diseases, the autocratic regulation of their daily exercise is the most valuable aid that medical skill can offer them. The decided effects of the altitude in exciting and disturbing the action of the heart in sensitive persons, even without disease, is shown by many, who, after living comfortably for several years at this elevation, 6000 feet, ascend to the summit of Pike's Peak, 8000 feet higher. These persons, while there, except for a feeling of light-headedness, are all right as long as they do not attempt to walk, when even a few steps taken will bring on rapid and often irregular beating of the heart, generally slight headaches, and often nausea and diarrhœa, and, in some, slight precordial pain, the headache and pain over the heart often persisting more or less for twenty-four hours after their descent. In cases of valvular lesions in which there are no secondary complications, and there are exhibited accommodation and tolerance both local and constitutional, to the impaired working of the organ, and while the patient is prudent, are decidedly benefited by the tonic effects of altitude.

With respect to nervous affections of the heart, the question of climatic influence must be approached from the nervous, and not the cardiac, end of the subject. Cases of anæmia and chlorosis are invariably relieved by the Colorado climate.

Lungs, respiration. That the first effect of altitude is to increase perceptibly the number of the respirations, and that subsequently they return to their normal frequency, is a fact confirmed by all observers. Further, in healthy persons, and in those in whom extension of the disease—pleuritic adhesions or considerable fibroid tissue—does not pre-

vent, there is a permanent increase of expansion as shown by measurement. The deductions from these facts are: that, in consequence of this permanently increased expansion, each air-cell must be expanded to a greater extent than before, and that the apices of the lungs, where the expansion is often deficient, receive the benefit. As a result of this increased use, the pulmonary elastic tissue should be strengthened as well as the muscles which assist respiration. Therefore, the effect of altitude is first to excite and hurry the respiratory act, and secondarily to make its mechanism more powerful and complete; next, as more air, therefore, enters the chest and permeates it more thoroughly, the blood supply must keep pace with it, both for this reason, as well as on account of the general vigor imparted to the heart's action already dwelt upon. The increased perfection of the respiratory act must, also, insure a more rapid oxygenation of the blood, and this is shown by the general ruddiness imparted to the complexion, and by the improvement in disorders contingent upon increased venosity. This physiological condition of active congestion of oxygenated blood in the pulmonary tissue necessarily tends to remove chronic congestion of an adynamic type, on the one hand, while active congestion being a necessary precedent stage of inflammation, when it occurs the lung is, in itself, more ready than usual to take on acute inflammation, with great celerity and force if the exciting cause arises. This is shown by the rapid, and often violent, onset of pneumonia, the not uncommon appearance of pure hæmoptysis, instead of mere rusty sputum, and the early crisis reached in the disease. The relative number of cases of acute pneumonia to the population is probably less than in most parts nearer sea levels and corresponding in latitude, because the general health of individuals is better, and there is also usually better hygienic surroundings. But it would appear that acute pneumonia arises in elevated regions with a less apparent exciting cause than it does lower down, and if this is a fact, the physiological conditions just stated would explain it. The same tendency toward acute congestion being present in the pleuræ, acute pleurisy, like acute pneumonia, would appear also to arise with less exciting cause, other circumstances being equal, in elevated countries than low ones. The comparative frequency of dry pleuritis is noticeable, effusion seldom occurring, and when it does, rarely being excessive or chronic, and rarely turning to empyema. Acute bronchitis and acute catarrhs of the upper air-passages are also, allowing for the infrequency of other causes than climatic being present, more frequent.

Before passing on to consider the influence of Colorado upon these

affections in a chronic form, let us return to some of the climatic factors and their physiological results. The effects upon the circulation and respiration, so far discussed, have been considered as due entirely, as they are undoubtedly mainly, to altitude and its resulting tenuity of atmosphere and deficiency of oxygen. But with these there is a great diminution of watery vapor in the atmosphere, and in consequence of this thinning of the veil between us and the sunshine, both its heat and light are more intense; while this dryness of the air leaves little to retain the sun's heat, and consequently alongside of great heat in the sunshine there is great coolness in the shade, and following warm days come cool nights. These contrasts, owing to the greater dryness at that season, are much more strongly marked in winter than summer.

Both climatic and physiological observation tend to confirm the opinion that, at an altitude, there is a greater energy of electrical force and a larger proportion of ozone. But too little is known at present to admit of discussing here their practical effects with much profit.

The quality of purity remains, which the air of Colorado climates usually shares with that blowing over wide deserts, plains, seas, or lakes. That where the local conditions imposed by man do not conflict, this air is peculiarly aseptic and pure is unquestionable. That it should especially be so in the locality we are now considering, is obvious to those who know how there is an absence of any appreciable poisoning of the air by man, and an absence of decaying vegetation, or a damp soil retaining in or on its surface stagnant water, and there is the constant presence of breezes which blow by day from off the vast and almost uncultured and unpopulated plains, and by night from the Rocky Mountains, clad with pines and innocent of pollution by man or beast.

That there is any zone of absolute immunity from phthisis, or any other disease, dependent on any special antiseptic quality of the air, is evidently not the case. Phthisis, and all other diseases not purely endemic, can and do arise in elevated regions, such as Colorado; however, owing to the abundance of unpolluted air diluting, strong light and heat purifying, and dryness retarding, putrefaction, man can defy the goddess Hygeia with greater impunity than in most parts of the earth's surface; but even here sanitary crime is visited sooner or later with retribution.

That the amount of water excreted from the lungs is increased, and the excretion of carbonic acid gas made easier, is undoubtedly so, and this necessarily follows, not only on account of the physiological reasons given for the general increased activity and completeness of the respi-

ratory act, but also especially on account of the dryness of the air inhaled, promoting a free exosmosis from the pulmonary tissue, both of water and gas. Not only is the excretion of water increased from the lungs, but evidently from the skin as well, the law of osmosis having a similar effect upon it. A person coming from a humid atmosphere near sea level to a dry atmosphere at an altitude, will find under equivalent conditions of temperature and exertion, that whereas in the first he was obviously perspiring, in the second he is not. Now, knowing as we do the physiological laws governing these phenomena, we cannot but conclude that the act of perspiring is being carried on more vigorously at an elevation, and that its common evidence in the form of sweat lying upon the surface of the skin is so little, if at all present, because the dry air immediately converts it into vapor.

That there is, at least, a transient, and generally a permanent, increase of appetite and assimilation of nourishment would be expected from the general activity given to the circulation and respiration and the promotion of osmosis, whereby loss of substance is promoted and nourishment thereby invited to take its place.

That there is provoked a greater energy of the muscular and nervous system is doubtless true. The best evidence afforded of the effect upon the muscular system is given by horses. Horses, for some weeks after coming, can only be worked very moderately and driven very slowly until their hearts and lungs become accustomed to the difference of the strain put upon them; at the same time they are usually made excitable and inclined to go, though more quickly tired. Such are the first effects; but the permanent are that horses can be worked harder and faster, other things being equal, at an altitude than at sea level. As far as I have been able to observe, their powers last, also, to as great an age. The evidence afforded by observation upon man agrees with this, but as it is necessarily so much more complicated by qualifying conditions and circumstances, it is not so easily demonstrated.

That the energy of the nervous system is also increased is evidently the case. The first effect upon most persons is to increase their liveliness and animation, and later, to enable them to carry out mental labor with greater speed and efficiency. However, the evidence is clearer in pathological conditions, or as shown upon special temperaments. Those of a nervous disposition are made more nervous, and those of a phlegmatic more energetic. Inflammatory and hyperæmic affections of the nervous system are usually aggravated, while those of an anæmic or adynamic type are inclined to be benefited.

Pain would appear to be greater, when present, in proportion to its cause.

Sleep is usually promoted as a first effect upon the healthy, and also upon the anæmic; but upon the ordinarily nervous, where the nervousness is not dependent on anæmia, or other cause, it is quickly removed by the climatic change. The effect is to produce sleeplessness. The secondary effect is often, even on those upon whom the primary influence has been toward sleep, after prolonged residence, toward sleeplessness.

That there is an improved formation of blood and nourishment of the organs, as stated by Dr. Weber, is undoubtedly true as a consequence of what has already been stated.

Temperament. In the treatment of chronic disease, these are the problems for the physician's solution: how to treat the disease and the patient, and sometimes, were it possible, it would seem as if the individual were best treated at sea level, and his disease at an altitude, or *vice versa.* Let us, then, consider the general bearing of individuality as affecting the question of change to Colorado, making, for the time being, an arbitrary separation of the man from his malady. We all recognize, as did our forefathers in medicine, the fact that there are certain marked individual tendencies and peculiarities which we group under the name of the temperament. Of course, in most individuals these temperaments are mixed, but even then one usually predominates over the other. In the perfect man, these different tendencies would be evenly balanced, each, in turn, coming into prominence, as it was called forth to oppose some outward influence of an antagonistic and injurious tendency, and subsiding back to the general level when the cause which had excited it was removed. The essentials of the differences of temperament appear to be founded on the power of receiving and answering to impressions made upon the nervous or circulatory system. With reference to the effect upon the nervous system of impressions, we may divide them into nervous and phlegmatic, and with respect to the circulatory system, into sanguineous and lymphatic; the nervous tending to answer quickly and with exaggeration, the phlegmatic slowly and generally feebly. With regard to the circulatory system, the sanguine or plethoric answers quickly and forcibly, tending toward active congestion and inflammation and overheating; the lymphatic or anæmic answering slowly and feebly, and tending toward passive congestion, chronic inflammation and coldness. Accepting for convenience these definitions of temperament, it can be seen why we observers of the effects of alti-

tude are probably right when we believe that the nervous are not as well suited for treatment at an altitude as are the phlegmatic and anæmic, since the climate exaggerates the exuberance of the first, while it remedies the deficiencies of the second. In determining the climate best suited for a given case of sickness, the effect of the climate upon the disease directly is of so much importance as often more than to counterbalance the possible antagonism upon the score of temperament. But, as a rule, the patient does best whose deficiencies or exaggerations in temperament are not magnified, but rectified by the climate. The depression in general tone induced by grave chronic disease is often such as to bring the invalid, for the time being at least, into the anæmic or phlegmatic class, who, in health, would appear in the plethoric or nervous. The limits necessary for this article prevent my dwelling longer on this interesting subject of temperament and chronic changes, which appears to be more worthy of study than has been usually considered, but I will pass on to the subject of phthisis.

Phthisis.

Formerly our practice was, in almost all grave affections of a vital organ attended with more or less inflammation, to give rest, procured by opiates or quiet. Now the pendulum of medical opinion swings the other way. We try and stir up the healthy life of the organ, and generally actively increase, whilst regulating, its functions. The old treatment of phthisis by cough opiates, by physical rest, and by sedative climates, is now discarded. Some have adopted, instead, what may be termed negatively beneficial climates—where the elevation and general change of climate are not sufficient to stir up any great functional excitement, but where certain bad elements in the patient's home weather are eliminated, and where they can enjoy more of outdoor life; whilst the more radical advocate treatment in such countries as Colorado, where, even when the body is at rest from locomotion, increased functional activity is still continuously produced. Some demand for their patient elevation, dryness, equability, and freedom from dust combined. If, by equability, is meant equability of temperature, they cannot get the combination. Warm days and cool nights, hot sunshine and cool shade, are, as a study of meteorology will show, necessary ingredients in all elevated climates. If equability as regards wind is meant, shelter from excessive wind can be procured in special nooks; but there is, for very evident reasons, a constant movement of air, although often gentle, at all high places. An absence of dust is also difficult to pro-

cure at an altitude, unless in the summer the ground is kept moistened by showers, and in the winter covered by snow, as the soil in all places where consumptives should be is dry and light, and therefore easily raised even by light winds. There are, however, places where pine woods and the immediate neighborhood of hills give shelter from the most frequent winds. With this shelter and comparative stillness of air, there are drawbacks. In fact, as might be supposed, each place has its drawbacks, and in the case of each invalid it is necessary to take a choice of evil as well as good.

Colorado Springs, though sheltered from the worst storms, is exposed to an almost constant movement of air, and the soil being dry and light, dust is raised during high winds; whilst in places sheltered by hills and pine woods there is a certain shortening of the hours of sunshine, often a drawback in winter, and a loss of the advantage, of a more constant change of the air in keeping it pure, and of the stimulating and revivifying effects of moderate winds. The proximity of hills and woods, too, renders evaporation slower, and by confining it, prolongs the damp influences of rain and snow. So that, though both are tonic, the more exposed air is the greater of the two, although it may be too strong for a given case.

Space does not permit me to dwell in detail upon the various forms and phases of phthisis, and the special influence of the climate upon each. I will, therefore, give only a few opinions as results of my experience.

The most marked benefit is shown in antagonizing and arresting tuberculosis in those whose ancestry or physique, or both, convey the impression of their being affected with general tuberculosis.

Hemorrhagic cases are found to do well.

Phthisis consequent upon croupous pneumonia, or pleurisy, is generally benefited.

The presence of a cavity is not, in itself alone, a bar to coming and reciving good.

Fibroid phthisis is usually improved.

Cases of so-called catarrhal pneumonia generally do well, but where there is a marked tendency to acute febrile catarrhs of the tubes, or a specially irritable and useless cough, a more medium climate is indicated.

Rapid progress and pyrexia are not contraindications, if there is evidence of a sufficiency of healthy lung remaining and if the patient is able to take and assimilate enough food, and shows a fair power of

reacting to stimulation by cold, and a capacity toward recuperation from fatigue.

Very moderate dilatation of the heart in the young is not a positive preventative, if care is exercised. Nor is old valvular disease, if tolerated with and compensated for.

Albuminuria caused by lardaceous disease would be a decided contraindication. Any renal complication makes the experiment of change to Colorado extremely risky for precipitating the end, though chronic Bright's disease, without pulmonary disease also, is usually favorably influenced.

Chronic catarrh and inflammation of the throat, nose, or bronchi, are generally improved, and even tubercular laryngitis is, *per se*, not contraindicated.

To sum up, as regards the individual, the anæmic and phlegmatic are best influenced as regards the disease; the chronic, as regards the stage of disease.

A larger margin of sound tissue in the peccant organ is demanded than in changing to a less extreme climate, and a certain evidence of vital resiliency is imperative.

With respect to pulmonary disease, let it be especially remembered that in sending your patients to Colorado, you are putting them, as it were, in a gymnasium, and they will need prudence and instruction to benefit by it; that the whole principle of the influence of altitude upon chronic disease is the exciting of a healthy life in the place of an unhealthy, and that in the process there comes the strain of the battle; that in prescribing an altitude, to insure success, as in prescribing the most powerful remedies from the Pharmacopœia, the method of administration demands our most careful consideration.

Taking the medical profession throughout the world, it is unquestionable that a large majority of those who have made a study of the subject believe that where a change is made, a change to an elevated country is the most likely to benefit a consumptive.

The population of Colorado, which grows rapidly, is evidence of its general merits as a resort for consumptives, and this especially applies to Colorado Springs, the healthiest, most agreeable, and accessible town in that country. There are places that are warmer or more sheltered, better suited for some. There are places that are lower or higher, better suited for others. For an average case of phthisis, however, this resort contains a greater number of advantages, both climatic and general, for residence, taking the year round, than any other now accessible.

To build up statistics of cases to prove the merits of Colorado Springs might not be difficult, but they would be misleading. A number of cases come only to die. A good climate being like a good doctor's practice: there is a mortality among his patients, out of proportion to his skill, because he is the resort of the desperate. And again, there is no country where the invalid fool is more surely and quickly punished for his neglect of good advice, so that, though I hope at some future time to present certain clinical records for your consideration, I will not attempt to build a monument with them to the curative power of this resort. I would rather ask you to look around among our numerous recuperated invalids now living in Colorado Springs or back in their old homes, and reply "Si Monumentum queres circumspice."

THE RELATIVE IMPORTANCE OF DIFFERENT CLIMATIC ELEMENTS IN THE TREATMENT OF PHTHISIS.

By EDWARD T. BRUEN, M.D.,
OF PHILADELPHIA.

THERE have always been popular descriptions of climate from the pens of travellers and valetudinarians, which have been more or less impartial, as the writers were more or less interested in the development of a special resort. In recent years the study of physical geography has widened our knowledge of the various climates of the globe, but exact statistics to the effect of climate on the physiology of thoracic organs are still wanting, as well as a knowledge of the effect of climate upon bacterial organisms. Moreover, in our own land changes have been induced by the settlement of the country, so that it is still true that a definite scientific idea of the real healing property possessed by climate is yet to be formulated, and it is difficult to settle positively the relative importance of the different meteorological elements.

In this article I shall only consider the effect of different climatic elements upon a single disease. From the standpoint of the clinician the relative advantages of different climatic elements in the treatment of phthisis depend upon the view which may be adopted of the etiology of the disease.

Experimental evidence, by inoculation of tubercular material, seems to afford cumulative testimony as to the specific character of phthisis, viz., that tuberculosis is an infectious disease, and that the tubercle bacilli are the infecting agents; but a careful analysis of the history of tuberculosis indicates that both bacillary infection and unhygienic surroundings are necessary to bring about the disease.

A glance at the modes of tubercular infection may afford a hint as to the relative value of climate in the management of impending phthisis. Many French[1] and German observers have shown that the

[1] Especially Kelch and Vaillard: Bulletins de la Société Médicale des Hôpiteaux de Paris, 83.

majority of pleurisies, which are not traumatic, pyæmic, or rheumatic, are tubercular. Bacilli can enter a part only by means of the canals or ducts which penetrate it, or by the blood or lymphatic vessels. Infection of the individual can occur by means of the respiratory system, the alimentary canal, the genito-urinary tract, and even the outer epithelial surface. It has been further shown that bacilli may enter the body by means of the alimentary canal without causing any lesion at the place of entrance; for example, in the mesenteric phthisis of children. Baumgarten has even shown that the bacilli may be directly inherited, and transmitted from parent to offspring.

This variety in the mode of infection indicates that a broad view should be taken of the influence of climate upon health, and justifies the statement that the relative importance of climatic elements for those predisposed to phthisis resides in the selection of that climate which, in each individual case, tends most toward fortifying the physiological structure; and, therefore, antagonizes the invasion and progress of the disease. An additional support to this view can be drawn from the observations of Metzchinkoff, who has seen the lymph cells of the frog englobe and destroy anthrax bacilli. Wyssokowitsche, also, found the microbes, which he injected into the circulation of animals, taken up by the endothelial cells of living capillaries of various organs, where they finally became destroyed. Watson Cheyne, in a review of some of his recent experiments, after describing the manner in which large quantities of putrefactive and non-pathogenic bacteria were destroyed when injected into the blood of rabbits, adds, "but this does not occur if the animal is in a bad state of health."

It has been demonstrated that the extent and character of the lesions produced in tuberculosis are due to the number of bacilli which enter a part, and to the manner in which they enter.

There are three characteristic forms of tuberculosis: first, acute, miliary tuberculosis, which is an acute infectious disease, due to general blood infection by large numbers of bacilli entering the blood current. Second, disseminated tuberculosis, in which there is also general infection of the blood, but the bacilli which enter are fewer, or they enter at intervals. Third, the tuberculous pneumonia, affecting larger or smaller portions of the lung parenchyma, and due to the aspiration of large numbers of bacilli furnished by a focus of the disease, usually a cavity in the lung.

In the acute forms of tuberculosis, climatic treatment is certainly unavailing; in the tubercular pneumonias the same is largely true; but in the forms of disseminated tuberculosis, which are more slowly

developed, and particularly those in which there is a tendency to the formation of fibrous tissue, the climatic treatment is proportionately valuable. The climate is yet to be discovered which will annihilate the bacillus of tuberculosis, but by appropriate climatic and hygienic treatment we may not only prevent the development of phthisis in those predisposed to the disease, but also strengthen the constitution so that further tubercular invasion may be retarded and the phthisical process rendered latent. What, then, is the relative importance of different climatic elements in accomplishing this result?

Cullen has written that the air of any place is better for the patient than that in which he grew ill. When one becomes a valetudinarian the habits of previous living are reversed, active out-door exercise is usually substituted for sedentary in-door life, and, in addition, the habits are changed in connection with a salubrious climate.

A striking illustration of the influence of environment is found in Mathews' paper, read before the American Climatological Association, on "Consumption among the Indians." He has shown that the death-rate among the Indians on the reservation, and in those residing in the most highly civilized parts of the United States, is much increased under the influence of civilization—*i. e.*, under the compulsory endeavor to accustom themselves to the food and the habits of an alien and more advanced race, and that climate is no calculable factor in this increase.

A favorable climatic environment to increase general vigor may vary in accordance with the individual idiosyncrasy; with some a cool or cold climate is naturally preferable to warm or hot; some improve in rarefied air, others at the sea level, while it is generally conceded that a dry is preferable to a moist, a sunshiny to a cloudy, climate. Variability is of less essential importance, but is an element of climate which must be considered in individual cases; as, for instance, in those who possess feeble circulations, and who are unable to take much exercise. Again, equability of climate may, on the same grounds, become a factor to be considered from the standpoint of the individual case.

An inquiry instituted in Saxony, at the expense of the government, proved that elevation had nothing to do with immunity from phthisis, very high localities in the Ertz and Reisengebirge exhibiting a large percentage of phthisis as soon as the industrial arts, such as mining and the manufacture of china, were prosecuted there; while, on the other hand, the percentage in the low lands was diminished where the people were engaged in agriculture and cattle-raising.

At the period of the discovery of the Sandwich Islands, in 1778, the Hawaians, according to Surgeon-General Wood,[1] were physically and mentally superior to all the other Malayo-Polynesian races. Climate, soil, and general environment having remained the same, we must account by a change in the habits of life, for the astonishing increase of disease, and the deterioration produced by a century of civilization in the Hawaian race.

Fothergill has shown that the effect of town life is to produce a distinct retrogression to a smaller, darker, precocious race of less potentiality than the rustic portion of the community.

Dr. Loomis has claimed for the air of pine forests a valuable antiseptic and corrective property, diminishing putrefactive changes in the lungs, and the multiplication of bacteria. But the influence of life amidst the the pine forests is, after all, rather to enhance general vigor by the effect of a suitable environment with outdoor life, and not directly by destroying the specific poison of the disease.

Ozone has always been thought to be present in large amounts in the air of pine forests, on the ocean, and at high altitudes. It is said to have the property of chemically purifying the atmosphere by combining with the products of decomposition. Again, Schmidt, of Dorpat, is of the opinion that all processes of oxidation within the organism are accomplished not by oxygen, but by ozone; oxygen outside of the body being scarcely able at the temperature of animal heat to bring about the oxidation of highly organized bodies. As we cannot definitely determine the amount of ozone in an atmosphere, it becomes an attribute of climate of uncertain value. Ocean voyages are relatively important chiefly from the character of the cases which receive benefit from them. Ocean climate insures great purity of the atmosphere, and probably ozone in considerable amount, and the regularity of life may prove quieting to the nervous system. The ocean voyage is relatively superior to the seashore, because the dampness of the soil at the seashore is avoided. It is also settled that sea air has a beneficial influence upon the catarrhal processes of subacute or chronic bronchitis. For phthisical subjects the value of an ocean voyage lies in the bracing influence it exerts on the nutrition of those predisposed to the disease, and is favorable in some forms of fibroid phthisis in which bronchial disorders are prominent features.

It would seem, therefore, that the consideration of the etiology of phthisis would indicate that climate is of value to the individual pre-

[1] Trans. Section 16, Ninth International Medical Congress.

disposed to phthisis, not by a single or specific quality of the air, or by any definite combination of meteorological conditions. It is neither more nor less than pure air, uncontaminated by miasm or organic or inorganic substances. The chief purpose of climatic change is to increase cellular resistive power.

In phthisical subjects, suitable for climate cure, the relative value of different climatic elements may be determined upon simple lines, viz.: that climate most conducive to individual health under ordinary circumstances, a climate in which, according to individual preferences, fresh air, sunshine, and an out-of-door life may be freely enjoyed, and, in consequence, respiration, digestion, and hæmatosis proceed with the greatest activity.

Again, an answer to the question of the relative importance of different climatic elements in the treatment of phthisis may be drawn from a study of the climatic conditions most commonly demanded by physicians.

Dryness of soil is of the first importance, or such porosity of the same as shall practically insure it. If the soil becomes too dry, the continual absence of rain may prove a disadvantage, because the air may be filled with dust, from which it is mechanically cleansed by rain or snow carrying downward to the earth not only the solid particles suspended in the air, but also carbonic acid and ammonia. Rain is not an evil, unless it is associated with conditions of soil which favor continued dampness; still a locality subject to long-continued rains is necessarily not so climatic, since high relative humidity of the atmosphere is very undesirable.

The relative humidity of the atmosphere exercises a powerful influence upon animal and vegetable life. It is well known that inhabitants of a dry climate are, as a rule, thin and sallow, while those living in moist insular countries have well-developed figures, and fresh, ruddy complexions; so that a very dry atmosphere need not be considered of high relative value in persons simply predisposed to phthisis. It is otherwise with those already infected with phthisis, but even for these the question of atmospheric humidity is relatively less important than porosity of the soil; indeed, at moderate altitudes porosity of the soil includes dryness of the air. The maximum dryness of the air is commonly secured at high altitudes, but since many cannot endure the rarefied air, this climatic element must often be sought at moderate elevations, at which porosity of the soil secures dryness of the air; and, again, dryness of air must not be secured at the expense of a dusty atmosphere. A dry atmosphere favors inspissation of the blood by

increasing transudation of the skin, and will promote inspissation o the liquid elements of catarrhal inflammation; but, as Welch and others have shown, catarrhal inflammation is secondary to microbic infection rather than the reverse.

To those who believe in the specific nature of phthisis the researches of Metzchinkoff on the struggle of the cells of organism against invading microbes, show that dryness is chiefly of importance as an element of those climates which enhance general vigor. He points out that there are cases in which the general organism is invaded by microbes without any resistance being made by the phagocytes or cells which possess the property of absorbing and digesting microbes. Atmospheric dryness is probably unfavorable to the reproduction of the bacilli, but until definite statistics are forthcoming we commonly ascribe a high relative value to a high atmosphere from its effect in stimulating the general health.

Meteorology has shown that pulmonary phthisis and temperature have nothing in common. Pulmonary consumption, geographically considered, is neither favored by a low temperature nor prevented or cured by a high one. Equability of climate is practically unattainable, and statistics of the health resorts which send us the greatest proportion of benefited cases are those in which great diurnal variation occurs. Many regions in which the climate is equable are notoriously undesirable, as, for instance, the western coast of England, the Netherlands, Norway, the Equator, and the poles.

Equability of temperature only deserves consideration indirectly—that is to say, in connection with individual cases. When changes of temperature are very sudden or very great, a certain amount of vigor is necessary to react properly to them; persons with feeble circulations or advanced pulmonary disease will, therefore, find it necessary to consider equability.

Lastly, rarefied air *versus* sea-level pressure has been considered as a climatic element of high importance. This conclusion has been reached chiefly by observing that consumption in all latitudes diminishes with altitude. Physicians now are universally ready to recognize that in mountainous regions the air is rarefied and the respiratory activity increased. The air is also usually dry, and Pasteur has proven that organic substances are more numerous near the earth's surface than in the higher strata of the atmosphere, and they continue to diminish the higher we ascend, disappearing entirely when we reach certain heights in the mountains. It has, however, been shown conclusively that the unquestionable good results accruing to consumptives from a residence in the mountains are due to other causes than altitude

In elevated regions consumption can be developed the moment the inhabitants adopt an indoor life, associated with the confinement incident to the trades; while in the lowlands outdoor life diminishes the percentage of consumption.

Fifteen years ago MacCormac, an English physician, claimed that pulmonary consumption was an artificial product developed by inspiring air which had previously been expired; "re-breathed," as he expressed it. He went so far as to assert that there would be no pulmonary consumption if everybody would sleep with open doors and windows. Statistics, I believe, will ultimately show that the mere mechanical physiological influences of rarefied air are unimportant in the majority of cases, and we now know that, in some instances, high altitudes prove positively injurious.

The greatest benefit can be secured in the locality which possesses the purest air, a large percentage of ozone, the best drained soil, atmospheric dryness without dust, and the greatest proportion of sunshiny days, and especially where these results are attainable at a moderate altitude. This latter feature should be considered important, because should recovery occur it may be possible to return to ordinary elevations with safety to health; for while statistical proof is wanting, it is pretty well established that when an individual becomes acclimated to the rarefied air of high altitudes it is dangerous to health to return to ordinary elevations.

Finally, the position already taken in regard to the relative importance of climatic elements is supported by the character of the cases deemed suitable for climatic treatment. In selecting these cases the question of the special physiological effects of altitudes should be first considered. These specific advantages seem to be mechanical, and are chiefly those which result from the rarefied atmosphere. For example, it has been shown by Dr. Platt that the Peruvians at an elevation of seven thousand to fifteen thousand feet possess short, compact bodies and greatly hypertrophied lungs. Residence at high altitudes causes enlargement of the thorax, hypertrophy of the healthy lung tissue, and the development of pulmonary emphysema around tubercular lesions.

High altitudes are generally recommended for those cases free from pyrexia and all acute symptoms; in cases of hereditary or family tubercular predisposition; or in cases which manifest phthisis by early hæmoptysis; and in instances of imperfect thoracic and pulmonary development; in chronic, tubercular pneumonia without bronchiectasis and with tendency to formation of fibroid tissue; in chronic pleurisy in which the lung does not expand after removal of the fluid; and in spasmodic asthma without emphysema.

The climate of altitudes is acknowledged to be injurious to those who possess insufficient lung tissue to carry on respiration adequately in a rarefied atmosphere, such as cases of phthisis with double cavities, with or without pyrexia, and in those cases of tubercular infiltration in which at low levels the pulmonary area scarcely suffices for respiratory purposes. It is thought that in suitable cases evidence of improvement must be drawn from a diminished pulse and respiration rate, together with gain in body-weight, color, and muscular power; but these physical signs are not peculiar to improvement at elevated regions.

High altitudes are, then, peculiarly undesirable for mechanical reasons, and consequently for special types of disease such as emphysema, chronic bronchitis with bronchiectasis, and in diseases of the heart and great vessels. High altitudes are thought to be unsuitable for cases in which there is great irritability of the nervous system, since the dry air usually found in such altitudes diminishes the water in the blood, and acts as a powerful stimulant to the nervous system, increasing its functional activity and causing excitement and sleeplessness. High altitudes necessarily include variability, consequently are unsuitable for those persons advanced in years or in those younger persons who are too feeble to take exercise.

There are, therefore, a few mechanical effects peculiar to the atmosphere of elevated regions which render the climate of altitudes relatively objectionable in the management of certain cases; but, on the other hand, excluding these, the relative importance of altitude indirectly antagonizing tubercular phthisis has not been shown, and the good results attained in elevated regions for the class of cases already mentioned can be gained at any point possessing dry soil, pure, dry air, and sunshine, which will invite exercise and in turn promote hæmatosis and invigorate the general system.

Once more, in selecting a climate the preference of a patient for a warm rather than a cold climate should be consulted, and in the decision the only essential elements seem to be those already grouped, viz., dry air, porous soil, and abundant sunshine, for in almost all cases the profit to the individual is indirect from the effect of outdoor life. In selecting a climate its relative advantages should be set over against the disadvantages of localities not only meteorological, but also those relating to the patient's personal comfort and convenience, and as the requirements of a typical climate, though simple, are not easily secured at any one point, localities should also be selected in some measure with a view to the least expense and inconvenience of the individual.

THE COMPARATIVE IMPORTANCE OF DIFFERENT CLIMATIC ATTRIBUTES IN THE TREATMENT OF PULMONARY CONSUMPTION.

By VINCENT Y. BOWDITCH, M.D.,
OF BOSTON.

In offering my views upon this subject, I shall not presume, even were it possible in the limited time allowed, to give statistical evidence of the results of my own experience in the climatic treatment of phthisis. From the protracted nature of the disease satisfactory data can be given only after years of close observation of cases, and it is more with the hope of exciting discussion which shall lead to more thorough investigation of this most important subject than of giving new or valuable facts, that I have prepared this paper.

There can be no physician, I imagine, even of many years' experience, who does not feel, at times, a sense of helplessness when asked if a change of climate will be beneficial to his patient, and, if so, what climate shall be chosen. It is then that our lack of proper knowledge on the subject comes over us; it is then that the apparent difference of view, held by equal eminent authorities, makes us feel that the science of climatology is in its infancy only, and that from its very complexity it must have a slow growth.

In taking a broad survey of the different methods of climatic treatment in the last half century, we can say that, regardless of possible differences of detail in treatment of incipient phthisis, the modern method is strongly in favor of selecting cool or even cold invigorating climates by which the general system may be assisted in its efforts to resist disease, as opposed to the former custom of selecting the warmer, more debilitating regions with their generally depressing effects. Even when taking into consideration the greater attention paid now to hygienic matters, which has its favorable effect, yet the results of the modern method show it to be a decided step, in the right direction, for a large class of cases.

Let us now ask: "What, in the opinion of eminent authorities, are

the most important attributes of a climate for the treatment of incipient phthisis?

At the outset we must pause, being brought face to face with the fact that, in all tabulations of results, the word phthisis covers a variety of pulmonary affections, and herein lies one of the chief difficulties of our coming to accurate and definite conclusions. By accepting the presence of this well-nigh insurmountable difficulty, and keeping it in mind, we can, nevertheless, draw general conclusions with safety, and judge if the number grows less of those who die from wasting pulmonary diseases, be they of tubercular nature or otherwise, and, if so, what are the reasons of the decrease.

In Dr. Denison's admirable paper of last year, which gives us the keynote of the discussion to-day, he places at the head of the list the quality of *dryness* as opposed to *moisture*. Under this head we may include both dryness of the air and of the soil, and without discussing the question as to how these are largely dependent upon each other, it will be sufficient to say that the researches and opinions of many authorities justify Dr. Denison in placing this attribute at the head of the list.

The investigations of my father, about thirty years ago, as to the cause of consumption in Massachusetts, and shortly afterward, of Buchanan and Simon, in England, point most strongly to soil moisture as a cause of the disease, and, furthermore, show that removal from a damp soil to a dry one has frequently been followed by arrest of the disease. More recent researches in other regions (for instance, those of Dr. Pepper in Pennsylvania two or more years ago) have led to the same result. Jaccoud, Hermann Weber, and others quoted by them, while they lay the greatest stress upon *altitude*, yet speak of the dryness of the air which accompanies a rarefied atmosphere and the rapid drainage of the soil due to elevation as most important factors in the cure of consumption.

Jaccoud, in his enthusiasm for *altitude* as the most important factor in the treatment of incipient phthisis, lays much stress upon the mechanical effect of expansion which residence in a rarefied atmosphere has, upon the human chest, and in this view he is supported by Hermann Weber, C. B. J. and C. Theodore Williams, Denison, Solly, and others, and from their observations there is little reason to doubt that the frequent and deep inspirations made by patients upon arriving in mountain regions, to obtain the requisite amount of oxygen from the rarefied air, tend to expand the chest and to dilate the collapsed or obstructed alveoli of a phthisical lung. The full-chested

appearance of children in the mountainous regions of Colorado, as noticed by the two authors last named, goes to prove this fact.[1]

Apart from the mechanical effect upon the chest, authorities very generally agree that in altitudes, properly selected, varying from 1500 to 8000 or 10,000 feet, we find a combination of attributes favorable to the cure of incipient phthisis, and in addition to the one already mentioned, viz., *dryness* of the atmosphere and soil, we have the advantage of a cool or cold bracing temperature, clearness and purity of the atmosphere, with a large percentage of sunshine.

While fully acknowledging the weight of the opinions of those who regard altitude as *one* of the most, if not *the* most important element in the climatic treatment of phthisis, yet I must confess to being as yet unwilling to accept this without reservations. It is doubtless true that we find, as Dr. Denison says, at certain high altitudes a greater number of what we now consider the most important attributes combined than in less elevated regions; but I think we must be guarded in accepting this, lest from the result of future investigations we find that we have gone too far in this direction.

With my present conviction that dryness of soil and atmosphere are the most important factors in the climatic treatment of phthisis, I am much struck by the experience of Dr. Geddings, who for many years has studied the climate of Aiken, in South Carolina, and the results of phthisical patients who have been sent there. The town is situated between 500 and 600 feet only above the level of the sea, not high enough to exert any special mechanical influence on the chest by rarefaction of the air (on which Jaccoud lays so much stress), yet the atmosphere and soil are both very dry, and the bracing quality of the air is a marked feature.

From the results which Dr. Geddings has noticed, and from the experience of a few patients with whose histories I am acquainted, I find myself questioning as to how far the element of altitude *per se* is necessary, and whether other regions resembling the position and climate of Aiken are not to be found, where equally favorable results can be expected. In this connection, moreover, the facts spoken of by several authorities must not be lost sight of, viz., that in certain countries of decidedly low altitude there seems to be an entire immunity

[1] That these effects of altitude have a decidedly beneficial influence on the pulmonary condition there is little reason to doubt, even though Jaccoud persists in saying that the rarefaction of the air causes an *anæmia* of the lungs in conjunction with the other viscera, although other eminent authorities maintain that the lungs share with the skin the increased circulation due to removal of atmospheric pressure, which seems the more rational view. (Lubbock's translation of Jaccoud's "Curability and Treatment of Pulmonary Consumption," p. 293.)

from phthisis; for instance, the Kirgheez, in Asiatic Russia, who live on vast steppes, one hundred feet below the sea-level, and the inhabitants of the Faroe Islands and of Iceland, living at a very slight elevation, and under the most unfavorable hygienic conditions, are nearly, if not entirely, free from the disease. So far as I know, these countries have never been used as health resorts for phthisical patients, but probably the depressing effects of living in such communities would far outweigh any possible benefit.

As to the attribute of temperature, or, in other words, *coolness* or *coldness*, as opposed to *warmth*, in the climatic treatment of phthisis, there can be little doubt that, in the majority of cases of incipient disease, the former has the more favorable effect. The good effects of a low temperature lie chiefly in its bracing quality, its tendency to cause dryness of the atmosphere, and its unfavorable influence on the growth of the bacillus outside the human body, a fact which, to those who believe in the theories of Koch, is of marked importance. (The contrary is true of warm, moist, relaxing climates.) The importance of clearness and purity of the atmosphere, with the presence of sunshine, is so self-evident that one need scarcely discuss it. The effect of the lack of these elements upon healthy human beings is sufficient proof of the necessity of their presence in the treatment of disease, more especially in phthisis.

In connection with the comparative importance of different climatic attributes, a word must be said as to the difference between seashore and inland climates. Of necessity, no general law can be laid down on this point, but the weight of opinion may be said to be distinctly in favor of dry, inland climates for the treatment of incipient phthisis. The shores of the Mediterranean are famous as health resorts for consumptives, and although, in the opinion of Jaccoud and Hermann Weber, they are inferior to the island and mountainous climates, yet a residence in that region is doubtless of great benefit to many; the dryness of the atmosphere, and a large percentage of sunshine being two most noticeable features of the climate.

Opposed to the idea of preference being given to inland climates, is the fact that most of the health resorts for consumptives in England are situated near the sea, where the climate is decidedly moist, and soft. As to the results in the cure of phthisis in these places, compared with those in mountainous regions, I am unable to make any statement, but the preference shown by English physicians, in sending their patients to such dry, mountainous regions as Davos, in Switzerland, speaks strongly in favor of the latter resorts.

Speaking for New England, it can be said that, while exceptional cases may do well, the moist, harsh climate of our northern coast is distinctly bad for consumptives, and it is my custom, as it has been my father's for years before me, to advise removal from the coast, if only to retreat to some comparatively dry region eight or ten miles inland, where the rigor of our harsh, damp winds may be avoided. Very different are the effects of a sea voyage or its equivalent, residence upon an island several miles from the shore. The reason of this difference is not satisfactorily explained, but doubtless the purity of atmosphere, and absolute freedom from dust, have much to do with it. As a cure for phthisis, however, either method may be said to hold a decidedly secondary position.

By comparing these facts again, we find strong evidence in favor of the attribute of atmospheric dryness in the treatment of phthisis.

To state briefly my present views: I believe that properly selected altitudes possess a combination of climatic attributes which, according to our present knowledge, form the best means of cure for cases of incipient phthisis in which there are no symptoms that would contraindicate residence at a great height—*e. g.*, cardiac weakness, excitability of temperament, marked feverishness, or a pronounced emphysematous condition, all of which symptoms are, according to the authorities mentioned, apt to be unfavorably affected by altitude.

At the same time, I believe we have much to learn as to the possibilities of cure in less elevated regions, like Aiken, South Carolina, where the quality of dryness is present with a bracing atmosphere.

Still further, we have a great field before us in the investigation of the effect of residence in comparatively favorable regions near our homes, where, by the establishment of sanitariums, we can combine climatic, hygienic, and medical treatment in such a manner that exile from home and family may not be thought, in the future, of such paramount necessity.

In accordance with my father's and my own custom of recommending, in certain cases, a residence in towns favorably situated within a few miles of Boston, I have, for some time, felt that much more could be accomplished by the establishment of sanitariums for phthisical patients in these regions. I determined to make the attempt to get some suitable institutions for those who cannot afford to go far away from home, in Sharon, Mass., a town situated between 300 and 400 feet above sea-level, about eighteen miles southwest of Boston. The soil is of a very porous nature, the atmosphere of a markedly dry, bracing character, pine forests abound, and a line of hills, moreover,

shelter the town from our harshest winds. Through the generosity of one interested in the scheme, a farm favorably stuated has been bought, and, relying upon the assistance of wealthy citizens of Boston, I hope, with the aid of Dr. R. W. Lovett, to show, at some future time, that much can be accomplished in this way.

I was much pleased to find that Dr. Kretzschmar, of Brooklyn, several months ago, called the attention of the profession in America to the gratifying results of Dettweiler, in his sanitarium at Falkenstein, in Germany; of Brehmer, at Görbersdorf, in Silesia; and other now well-known establishments, situated in not especially salubrious climates. The experience of these physicians in Europe, as well as that of Dr. Trudeau, in the Adirondacks, should give us reason to hope that, by means of similar establishments near our homes, even at a comparatively slight elevation above the sea, we can do a great deal toward arresting the present death-rate from pulmonary consumption.

I cannot conclude better than by quoting Hermann Weber, who, in the fourth division of his exhaustive work on climatology, says: "By erecting well-arranged establishments, under medical supervision, in well-situated places near at hand, a great many of the advantages of more distant climatic health resorts may be gained."

INDICATIONS AND CONTRA-INDICATIONS FOR ALTITUDE IN THE TREATMENT OF PULMONARY TUBERCULOSIS.

By FREDERICK I. KNIGHT, M.D.,
of Boston.

It is generally admitted at the present day that the study of the climatic relations of pulmonary tuberculosis is an exceedingly complicated one, not only with reference to the origin of the disease, but also with reference to its progress and termination. It is also now generally admitted that an out-door life in the purest attainable air is one of the most desirable conditions to secure for those patients with the disease in whom its arrest is hoped for.

The purest, most nearly aseptic air is found on the ocean and at high elevations; but as, in order to be of lasting benefit, stay in the new conditions should be considerably prolonged, ocean air is out of the question for most patients, and one looks to the mountains for a place of prolonged residence. Here we have also, in the beginning at least, an increased respiratory activity, which acts beneficially on the nutrition of the pulmonary parenchyma.

It is, however, well known that high altitude disagrees with and is thoroughly unsuited to some tubercular patients, and it is for the purpose of guarding a part, at least, of these patients against an experiment in climate, the result of which might be an irremediable injury, that I ask for a discussion upon a few propositions laid down in a rather tentative way.

In considering the question of high altitude in this paper, I will restrict the application of this term to such elevations as will usually allow of prolonged residence without danger of anoxyhæmia (4000 to 6500 feet above the sea-level).

The contra-indication to altitude in the treatment of patients with pulmonary tuberculosis may be found to pertain to some general factor, such as the age or temperament of the patient, to the type or stage of the disease itself, or to some complication of other disease.

Is there any limit of age which would forbid or render less promising the residence of a tuberculous patient in high altitudes?

I am inclined at present to put such a limit at about fifty years. After that period the chest-walls are less elastic, the patient is more susceptible to cold and sudden changes of temperature, and at the same time less inclined to take active exercise.

Is there any temperament which should be prohibited a trial of the high altitude treatment?

It may be said that the energetic stimulation of the mountain air is suited rather to the phlegmatic than the nervous temperament, and that individuals of the latter type sometimes do very badly in it. These patients usually have an irritable heart, frequent pulse, and inability to resist cold. We must be sure, however, before denying a patient the benefit of this treatment on account of temperament, that we classify him properly, for there are patients, weak and irritable from disease, who at first might strike us as of a neurotic nature, but who are not constitutionally so, and who will improve quickly under mountain stimulation.

What is there in the nature or condition of the disease itself which may contra-indicate residence of high altitude?

For the sake of convenience, I will make use of the types of the disease employed by me in a previous paper.[1]

1. Patients presenting the earliest physical signs of tuberculosis of the apex, who have as yet shown little, if any, general disturbance from the disease, and who complain only of morning cough and expectoration.

These are the patients who are known to recover under a great variety of conditions, both climatic and social; but it seems to me, after considerable experience, that a larger proportion have recovered uuder the high altitude conditions than under any other. With a few exceptions, such as for general reasons previously mentioned, I should recommend high altitude for these cases.

2. Patients with more advanced disease, showing some consolidation, but no excavation, nor any serious constitutional disturbance.

High altitude is suited to many of these cases also; but if a considerable area of one lung, or the apices of both are consolidated, if the pulse and temperature are both always above 100, it may be well to try some low altitude first. When quiescence in the morbid processes is established, a change to higher altitude can be made.

[1] On the selection of a climate for patients with pulmonary tuberculosis. Boston Medical and Surgical Journal, April 5, 1888.

3. Hemorrhagic cases. Patient in whom pulmonary hemorrhage has been, perhaps, the earliest, and a frequently recurring symptom, but in whom there is, as yet, no marked febrile reaction, nor much physical evidence of disease.

In my experience this class has done particularly well in high altitudes. The tendency to hemoptysis seems to be diminished rather than increased. This seems to me to be explicable more through improvement in nutrition of the lung parenchyma than by change in the atmospheric pressure, for the lung cannot be considered an internal organ as far as atmospheric pressure is concerned, but must be considered as subject to the same pressure as the skin, and, therefore, in high altitude more liable to superficial congestion and hemorrhage. Theoretically, therefore, there was good reason for the old custom of avoiding the sending of such patients to the mountains, but practically I have never experienced ill results from so doing.

4. Patients with advanced disease; those with cavities, or severe hectic symptoms.

Patients with advanced disease, or, better stated, with great area of lungs involved, should not be sent to high altitudes. The demand for increased respiratory activity, which cannot be answered, is apt to be quickly followed by fatal result. The existence of a small cavity, in a case in which the disease had become quiescent, would not contra-indicate high altitude. Hectic symptoms would do so.

5. Patients in an acute condition.

None of these should be sent into high altitudes.

6. Cases of so-called fibroid phthisis or interstitial pneumonia.

If the patient is over fifty years of age, if his heart is dilated, or if there is great bronchial irritability, producing harassing cough, he should not be sent into high altitude.

7. Patients convalescent from acute pleurisy or pneumonia, in whom the eruption of tubercle is dreaded.

Unless otherwise contra-indicated, elevation is particularly suited to this class of cases.

8. Patients in whom the tubercular process has seriously invaded the larynx.

It is generally recommended by those familiar with them, that these patients be not sent to high altitudes. In view of modern methods of local treatment, they certainly should not be sent there to the deprivation of this; but should they be sent to high altitudes if they can also have the benefit of good local treatment? With others I have been prejudiced against sending these patients to the mountains, but it may

be that this prejudice is groundless for high altitudes which are free from dust, and that they do no worse here than anywhere, the disease when it has once seriously attacked the larynx usually pursuing an unfavorable course. I know that some of the resident physicians of high altitudes do not share this prejudice.

9. Those with complications of other diseases.

Much care should be exercised in regard to cases of this class.

One of the first in importance to suggest itself will be cardiac disease. Cardiac dilatation should preclude the consideration of altitude; and it would be safer to say the same in regard to most cases of hypertrophy, though if this be moderate and of slow development, the patient might be allowed some elevation. There are many patients, however, who are unwarrantably denied the benefit of high altitude on the ground of heart disease, *e. g.*, patients with a cardiac murmur the result of endocarditis quite long ago, in whom there is no evidence of deranged circulation, and no sign of cardiac enlargement. Of course, the mere existence of a murmur is no evidence of a cardiac condition liable to be unfavorably affected by rarefied air. On the other hand, there are some patients with nervous derangement of the heart who had better be advised against high altitudes. These, however, would usually be of the general neurotic type before spoken of.

Disease of the large bloodvessels is an evident contra-indication.

Patients with bronchial dilatation or pulmonary emphysema are not usually recommended to high altitudes, presumably on account of diminished respiratory area. I have not had much personal experience with such patients in high altitudes, but would like to hear from those who have had. There are some with excessive bronchial irritability who certainly do better in lower regions.

In regard to renal disease, while it is admitted by resident physicians that acute nephritis, like acute pneumonia, is severe in high altitudes, they claim that chronic nephritis is often benefited.

Intestinal ulceration would not contra-indicate a high altitude, but no great good could be expected from the change.

In cases of epilepsy, diseases of the brain and spinal cord, which are said by some to contra-indicate altitude, I have had no experience.

It looks to me as if the claim that heredity is a contra-indication of altitude must have originated in the mind of one who was afraid lest his percentage of cures should be lowered by bad cases, for, while admitting that patients with hereditary tendency to tuberculosis are on that account less favorable for any treatment, when taken in hand early they are especially benefited by mountain-air life.

Diabetes would seem properly to contra-indicate high altitude treatment, as its subjects are very liable to succumb to attacks of any acute disease, and these would be more liable to occur in a variable than in an equable climate.

Upon what grounds syphilis is put down by some as a contra-indication I know not.

The combination of tuberculosis and syphilis is a very unfavorable one, and liable to result badly in any climate.

THE CLIMATE OF COLORADO AND ITS EFFECTS.

By WALTER A. JAYNE, M.D.,
OF GEORGETOWN, COLORADO.

In the selection of a climate for a phthisical person the great desideratum is, Where may our patients find the purest and most aseptic atmosphere, combined with the other qualities suitable to their individual wants, in which they may spend the maximum of time under the open sky safely and agreeably, and still have those comforts so necessary to an invalid? Colorado affords these conditions to an extent hardly to be found elsewhere, since not only is the climate suitable for a very large class of consumptives, but from the great combination of elevated plains and mountains an invalid may find an all the year climate of infinite variety from which to select, while the large and growing commercial interests offer inducements for a permanent residence, with the very environment proves favorable to the arrest, if not cure, of this malady, phthisis. Thousands of the population of this State, who once belonged to this invalid class, but who are to-day useful, active citizens in the enjoyment of health and strength, attest the truth of these assertions.

The climate of Colorado has been so frequently and well described that it is unnecessary for me to dwell upon it in detail, but before speaking of its effects let me recall its most prominent features, those to which the favorable results are ascribed.

Situated near the centre of the United States, far from any large body of water; extending over four degrees of latitude, and seven degrees of longitude; traversed from north to south by the great Rocky Mountain range and its numerous spurs; with open plains, more elevated plateaus—or parks surrounded by mountains—and secluded valleys at varying altitudes, it offers a most surprising diversity of climate. In summer one may choose between the heated plains and cool elevated mountains, and in winter may, if desired, almost entirely escape the rigors of snow and ice, and find a balmy air

and the mild open winter of the South. The portion most interesting to us, because generally proving most favorable for the treatment of phthisis, is that lying to the eastward of the Continental Divide, and consists of open plains stretching away from the abrupt foot-hills at an altitude of from 4000 to 8000 feet, and the mountain parks and valleys.

The whole region is characterized by rarefaction, purity, and dryness of the air with a very large proportion of clear days and an abundance of sunshine.

The atmospheric pressure varies with the locality, since the elevation is from 4000 to 8500 feet. As in all high altitudes, the air is cool. though on the treeless plains the air in summer becomes much heated by day, but owing to rapid radiation the nights are invariably cool In winter the mercury often sinks below zero F., but the days are bright and sunny, and though the air may be cool, overcoats are often a burden, and one may frequently sit with open doors and windows, and even out-of-doors, with but little extra clothing. The temperature is not equable, but the great range of temperature, which is so marked a feature of all our meteorological tables, must not be compared with the same range in a low damp atmosphere, since, as gauged by the sensations, it is far less, and in practice is seldom found to do injury owing to the dry, stimulating quality of the air. While great and rapid changes of temperature do take place, these extreme variations are exceptional.

The purity and aseptic character of the air are decidedly greater than at low elevations, and germs find little pabulum and few places in which to thrive. There are but few large towns, and the distances between them are great; the ranch population is scanty; and the soil is dry, gravelly, and porous to a great depth, and gives forth no noxious vapors; hence there is little chance of even slight contamination of the air by disease germs.

The air is dry. The moist winds from the Pacific are cooled by their passage over the intervening mountain ranges, and the clouds have deposited the greater part of their moisture, most of them are dissipated, and few cross the last and greatest range. The annual rainfall is between fifteen and sixteen inches, and the actual humidity is less than in any other portion of the Union, except in the territories of the northern part of the United States during the winter months. The returns of the United States Signal Service show that the mean relative humidity at Denver for the past four years was (100 being saturation) 52.5, 57, 55, and 51.2, respectively; while at New York

for the same years, 1884, 1885, 1886, and 1887, it was 73.3, 73, 73, and 66.5, respectively. A more certain test of the dryness of the air is the actual humidity, and from the United States Signal Service charts of the year 1882, we find that during the spring of that year the air contained an average of 1.5 grains of moisture to the cubic foot, during the summer 3.5 grains, during the autumn 1.5 grains, and during the winter but 1 grain, and the reports of subsequent years show very nearly the same averages, demonstrating the atmosphere of the region about Denver to be the dryest of any portion of the United States, with the exception noted.

The greater portion of the rainfall of the year takes place during the spring and summer months, in the daily afternoon showers, rainy days or continuous rains being exceedingly rare. The snowfall during the winter is light and the snow lies upon the ground but a short time, melting and sinking into the ground rapidly under the warm rays of the sun. Fog and mist are almost unknown.

Winds at certain seasons of the year are common, and in towns and in those portions of the State having adobe soil, frequently raise quantities of dust. They are disagreeable and annoying, but they bear with them no peculiarly injurious effects beyond mere physical discomfort when exposed to them.

The phenomenal amount of clear, pleasant weather, the bright sunshine, especially during the winter months, is the most striking feature of the climate to a newcomer. By again examining the reports of the Signal Service for Denver for the years 1884, 1885, 1886, and 1887, we learn that there were 39, 57, 40, and 40 cloudy days, respectively, for these years, and it is fair to presume that on very many of these cloudy days the sun shone, since other reports compiled from the same source from the observations of fifteen years, state that there were on an average of 345 sunny days each year during this period, while the yearly average of cloudy days was 56. We also find, by referring to the same records, that the mean cloudiness is less here than elsewhere in the United States, except in Arizona during the spring, and Central California during the summer. In winter the cloudiness is less than during any other portion of the year, and the proportion of clear, sunny days is consequently greater. Owing to the clearness and dryness of the atmosphere, the sun's rays lose less heat in their passage to the earth than in low, damp climates, with the result that the open air of winter on clear days, though cool, perhaps even cold, is agreeable and comfortable with light wraps while in the sun, and pleasanter than the artificially heated atmosphere within doors.

The differences between the climate of the plains and that of the mountain parks and valleys are such as usually obtain between mountains and an open country, though more pronounced. There are few places in the mountains where meteorological records have been kept, but in comparing Georgetown, situated in the mountains, some 3300 feet greater elevation than Denver, and 8500 feet above sea-level, it is found that the mean annual temperature is from seven to eight degrees lower. For the year 1887 the mean annual temperature of Denver was 50.4° F., of Georgetown 42.3° F. The summers are decidedly cooler, the thermometer rarely registering 85° F. in the shade during the warmest days, while at night the mercury falls to from 65° to 60° F., and often lower. The mean temperature of Denver during the summer months of 1887 was 69.1° F., of 1888, 68.4° F.; of Georgetown, for the same periods, it was 58.3° F. and 59.1° F., respectively.

The winters in the mountains are more prolonged. The temperature on sunny days is not so high, and though the mean temperature is less the mercury does not sink to so low a point during the prevalence of northerly winds. The extremes of temperature are, therefore, not so great. During the winter months of 1886 and 1887 the mean temperature of Denver was 33.5° F., of Georgetown 27.2° F.; during the winter months last past the mean was 31.6° F. at Denver, at Georgetown 26.4° F.

The rainfall is a trifle less and the number of cloudy days is slightly greater in the mountains than on the plains. During the year ending June 30, 1888 (the only one during which such a record was kept), there were but twelve days on which the sun did not shine in Georgetown; four of these were during the winter months. The purity of the air is, I believe, greater in the mountains than on the plains.

I have thus briefly and imperfectly sketched the general characteristics of the climate of Colorado, those to which so many consumptives owe their lives and restoration to health, and which render the mortality of this State less than that of any other, notwithstanding the numerous deaths from phthisis of persons coming within its borders when all chance of benefit is irretrievably gone, and who reach our wondrous climate only in time to die.

In Colorado we have a remarkable combination of those climatic conditions most desirable for an invalid wishing to live as much as possible out-of-doors—a dry, bracing, stimulating atmosphere of great purity, of which rarefaction is a most important element, together with a maximum of pleasant weather and an abundance of light and sunshine, especially during the winters. Not only is it possible for an

invalid to spend the whole summer and fall in camp, but when winter comes and it is desirable to be under more secure shelter, the patient is still enticed out under the open sky to engage in out-door amusements and occupations by the warm sunshine and balmy air, with a soil free from mud and dampness.

There can be no uncertainty as to the desirability of such a rare climate in phthisis; the difficulty is simply in determining and eliminating those cases not suitable for treatment at high altitudes. The class of phthisical patients deriving benefit here is a very large one, but there are some who do not improve and should never be advised to test the effects of the climate of great elevations.

After several years spent in the practice of medicine near sea-level on the Atlantic coast, and coming to Colorado an invalid, the effects of high altitudes in health and disease have been somewhat striking, and have necessarily occupied a share of my attention during my five years' residence. My observations have been made mainly in Georgetown, a town situated in a deep mountain valley 8500 feet above sea-level, and my further remarks will relate solely to the effects of this considerable elevation.

The most marked effect of the climate of this altitude is due to the rarefaction of the air, and upon persons coming from near sea-level, while often very decided, differs greatly according to individual peculiarities, some scarcely noticing the change, while others are made decidedly ill. The most noticeable effects are slightly increased frequency of inspiration, and perhaps a feeling of insufficiency of respiration, supplemented occasionally by a sigh, with quickened pulse—generally from six to eight beats per minute—and may be a more forcible beating of the heart; but with the majority of persons there is no other inconvenience than shortness of breath after some exertion, as making an ascent, and possibly a tendency to wakefulness the first night or two after arrival. Rarely, there is a feeling of giddiness, even faintness, with headache, and a light, restless sleep at night, disturbed by troubled dreams.

If the heart is sound, and the lungs all right or but slightly affected, these organs adapt themselves to the new conditions in a few days, and the newcomer notices no effects of the increased elevation, except on considerable exertion.

In fleshy persons, or those with weak heart, the rapidity of the pulse is greater, the palpitation more marked, with perhaps a feeling of faintness, while in those of full habit the color is less fresh, may be a trifle dusky, and they recover their normal condition more slowly.

Persons of a nervous, excitable temperament—particularly nervous women—in addition to the symptoms referable to the heart and lungs, complain of a feeling of unrest, nervousness, and unexplained anxiety, with sleeplessness, or, perhaps, a light sleep accompanied by disagreeable dreams. Such persons, and those with a muscularly weak heart, not infrequently faint in making excursions—even in a carriage—to a slightly higher altitude, and I have known instances of fainting even at an elevation of 8500 feet, with no disease of the heart discoverable. Dryness and harshness of the skin, with tendency to chapping of the lips and hands, are the rule with all. The kidneys are less active, the urine is higher colored, and it contains a larger proportion of solids than normal at lower elevations. Even those who have resided at a high altitude for a long time notice the lightness of the air, after an absence near sea-level of but a month or two.

The effects of this great change in altitude, as described, are rarely more than temporary, and give way to sense of general well-being, strength, and vigor, with buoyancy of spirits. The appetite is increased, the digestive processes become more active, sleep is sound, the functions of the body become more regular, and a feeling of perfect, robust health pervades the system. On the other hand, persons of a high-strung, nervous temperament often feel depressed and exhausted, and do not succeed in shaking off the languor until a lower level is reached. Those coming from malarial districts often develop transient symptoms of malaria shortly after their arrival.

I have never known hemorrhage to occur among newcomers, except in two instances. In both it took the form of hæmoptysis, and occurred in men of sedentary habits, just from their offices near sea-level, who had come to the mountains for a brief holiday. I believe both had disease of the lungs, and one had had several hemorrhages before. One within twenty-four hours, the other within forty-eight hours after arrival, took violent exercise, and went to an altitude of from 11,000 to 12,000 feet, and feeling exhilarated, and in buoyant spirits, declined to ride, and walked up rather steep ascents. The former spat a few mouthfuls of blood after return to his hotel; the latter some thirty-six hours after his climb, and at night after a second hard day, rowing and fishing, had a very severe attack of hæmoptysis. This man I saw a few days later. For about two months he had been in failing health, had had an annoying, hacking cough, and feverishness in the evneings, and not having his attention drawn to his lungs had attributed his troubles to malaria. When I saw him he was up and about, but had a temperature of 102° F. each evening, respiration 24, pulse 110

per minute, and I found considerable infiltration from lobular pneumonia at the apex of each lung. He returned home, and died within a year.

It may readily be supposed that such novel conditions affecting so intimately the vital processes of the body may cause illness in a person who seriously overtaxes the adaptability of the system. Let me illustrate with two of the most extreme cases I have met with:

A young man, a clerk, living near sea-level, came direct to the mountains. The following morning, noticing a prominent point of rocks overhanging the town, he scrambled up the mountain side some 2000 feet, more than 10,000 feet above sea-level, to get the view, and returned to his hotel late in the afternoon, much exhausted. Shortly after he was seized with a slight rigor, excessive shortness of breath, and severe palpitation of the heart, with cool extremities. He had a slight rise of temperature, almost gasping respiration, and a very rapid pulse. He was relieved in a few hours, and was about on the following morning, though very weak.

A young Englishman, who had always lived near sea-level, and never been to a greater elevation than 400 feet, came direct to Colorado, to an altitude of over 9000 feet. Being accustomed to active exercise, he spent entire days on foot on the mountains, and in visiting mines. After some two weeks of great and unusual exertion, he was seized with a slight febrile action, accompanied by a dry, hacking cough, shortness of breath, pain in the intercostal muscles, and palpitation of the heart, with soreness of the muscles, especially of the chest. The fever practically ceased in twenty-four hours, but the oppression of the chest, and intercostal pain, together with an amount of prostration out of proportion to the slightness of the attack, continued for ten days longer, but were promptly relieved by a short stay at a lower elevation.

What is the effect of residence at this altitude? The average expansion of the chest, as found by examinations for insurance, is greater than commonly found elsewhere, and in children the chest is proportionately larger and well developed. The skin is usually dry, though the insensible perspiration is probably greater than at lower levels in damp climates, and excessive perspiration occurs only after considerable active exercise. The urine is commonly of higher specific gravity than mentioned as normal, from 1024 to 1030.

The population of the mountains, as a whole, I have found to be an unusually healthy one, notwithstanding the fact that a large proportion of the men of this locality work in the silver mines, in bad air, in places dripping with water, and much exposed to cold draughts. The almost entire absence of bowel troubles, the infrequency of serious organic disease, of the more dangerous forms of continued fever, and

freedom from all malarial diseases, give as a result a comparatively small amount of sickness. Children are especially healthy.

Occasionally cases of general debility with loss of nervous tone and sometimes with slight anæmia are met among those who have lived continuously in the mountains for a series of years, and though it is often difficult to determine the precise share the altitude may have in producing the undefined symptoms complained of, yet it is found in practice that a change to some lower elevation has a most marked and prompt remedial effect.

The trouble most frequently complained of is so-called biliousness, generally in miners, the result of continued exposure and wet, and is a slight stomach disorder. If the attack is somewhat sharp, there are general malaise and some febrile action, with headache, backache, pain in the limbs, soreness of the muscles, and heavily coated tongue. In more severe attacks the above symptoms are intensified and preceded by rigors, perhaps a slight chill; the temperature varies from 102° to 104° F.; coated tongue, nausea, and vomiting of bile, distress in the epigastric region, with tenderness of the liver, sluggish bowels and dark, offensive stools. These symptoms are usually controlled with readiness if given prompt attention, and the patient is about again in from two or three to ten days. The disease may last a week or ten days in mild form, but shows no uniformity as to duration. It is seldom or never remittent, and if a relapse does occur it does so from a definite, accidental cause.

Such febrile attacks are called mountain fever. It is a mild bilious fever with hepatic congestion.

I have known cases of fever to commence as above described and last four weeks, with no single symptom of typhoid, the temperature varying from 102° to 105° F. a great part of the time, often as high or even higher in the morning than in the evening, without delirium, tongue moist, appetite fair, even good, bowels regular and natural, but little emaciation, and the patient asking each day to be allowed to sit up, believing himself free from fever. Prolonged attacks of fever, however, usually show a few symptoms of typhoid during their course.

Typhoid fever, as I have seen it in the mountains, has been, as a rule, very mild, lasting from two to three weeks. Commonly the only indications of a typhoid element are a few rose-colored spots about the commencement of the second week, and a transient relaxation of the bowels, with a slight and temporary tenderness over the right iliac fossa. The tongue is moist, the appetite fair, and the patient often feels so well that some persuasion is necessary to keep him in bed.

I have met with two cases which proved rapidly fatal. In these the onset was unusually rapid and sharp; dry tongue and ataxic symptoms developed very early, and the fever ran very high. I have seen but few cases with ataxic symptoms and those referable to the nervous system, but these have impressed me with the belief that the occurrence of these symptoms is of far graver import than at lower altitudes.

I have never observed any material difference in the course of the exanthemata. In diphtheria death from sudden heart failure appears more common.

Pneumonia is supposed to be both common and very fatal at high altitudes. I am not of that opinion without qualification, and my experience does not lead me to believe it is of more frequent occurrence among those who are acclimated than at lower levels; indeed, I am inclined to think it less so, and under similar conditions of prudent, careful nursing, no more fatal. I have found it to be neither common nor fatal among women and children. It might be supposed that, owing to the rarefaction of the air, the diminished amount of oxygen it contains, and the increased labor thrown upon the lungs, that the proportion of deaths would be greater; but, to offset this, the air is of great purity, and the health of the patient before the attack has generally been so robust that the disease finds the subject well fortified for withstanding the exhausting tendency of an acute disease. Pneumonia is, however, very fatal among those who, having been but a short time in the mountains, have been working hard, subjected to exposure under such unusual climatic conditions, in wet mines or in storms on the mountain sides at great elevations, and are seized with the disease, especially if saturated with alcohol. Living in comfortless, isolated cabins, as many men do, they have no conveniences when sick, and only the very indifferent nursing of comrades or comparative strangers, or of their families under poor surroundings. With these unfavorable conditions the disease is apt to assume a very acute and violent form, and often, when convalescent, they catch an additional cold, when the fatal result they would ordinarily have escaped promptly ensues. These circumstances would be attended by a large mortality in any climate, and here it should not properly be ascribed to the altitude, but to the peculiar, rough mode of life and lack of care which were so common in the earlier history of the State, and even now in many frontier settlements and mining camps. These facts have given rise to the general impression of the fatality of this disease at high altitudes without a careful analysis of the causes contributing to the

result. In acute lobar pneumonia, for the extent of lung involved, the respiration is from six to eight higher per minute. Hepatization takes place rapidly, and the expectoration is usually of a fresher color than at lower elevations.

Acute plastic pleurisy is not infrequently met with, but it has not been my fortune to see a single case of pleurisy, with effusion, during my stay in the mountains. I have had one case of empyema, this as a sequel to pleuro-pneumonia. Bronchitis, in the form of ordinary "colds," is not more common than elsewhere, and seldom proves more than a temporary indisposition, and does not tend to linger and become chronic.

Migraine and neuralgias are probably not more common than at sea-level. Chorea among children is rather common. Epilepsy I have but rarely met with, and have not known of the development of a single case. Enlargement of the thyroid gland among women is more frequently met with than in other places, but it never attains any great size. Exophthalmic goitre I have observed several times. Nasal and pharyngeal catarrhs are common and troublesome. Acute and follicular tonsillitis occur as elsewhere. Bowel troubles are, as I have stated, unusual, and are almost invariably promptly controlled by simple remedies. Children coming to the mountains with summer complaint usually recover quickly with little else than careful regulation of the diet. Dysenteric diarrhœas are very uncommon. Sporadic dysentery rarely occurs, and then in a subacute form. Acute dysentery with fever has come to my notice but once, and this was the result of fecal accumulation in a case of chronic constipation, and the patient had had several similar attacks before coming to Colorado. Those cases of chronic Bright's disease I have met with have been difficult to manage, though several cases of the acute form have yielded readily to treatment.

Diseases of the heart give trouble early in their course, and grow worse very rapidly. To this I do not recall an exception. I have carefully watched the development and progress of several cases of valvular disease—acute and mitral—and have noted hypertrophy, but no positive dilatation has taken place, except, possibly, in a case now under observation, it is as yet in its early stage, and has given no clear evidence of its presence. Those with fatty heart, or in whom the heart muscle is weak, are soon obliged to go to a lower altitude.

Acute diseases of an inflammatory character are more acute, as a rule, at high altitudes, and prompt measures are more necessary, while full recovery of strength from these, and particularly from fevers, is

apt to be slow, and is materially hastened by a short stay at a lower elevation.

Owing to the purity of the air and its freedom from germs and microbes, and the activity of the assimilative processes at this altitude, wounds heal by first intention more surely and with less strict attention to antisepsis than at sea-level. Cases of compound fracture and extensive wounds act more kindly, granulate and cicatrize more rap idly, and suppuration is far more limited than elsewhere, even when no particular attention is paid to the thorough purification and cleansing of the parts. Traumatic fever is very slight, or altogether absent. These facts are particularly apparent to a surgeon when recently from a low damp atmosphere.

A few medicines act peculiarly at high altitudes. Quinine is more active, and it is impossible to prescribe such doses as are given in the East without causing distressing symptoms of poisoning. Many women and children cannot take even the smallest quantity without distress, and I have had adults complain of cerebral excitement, nervousness, and cinchonism, after taking two doses, of two grains each, of the bisulphate at an interval of three hours. I have seen several persons wildly delirious, in whom the drug had been pushed, and the cause of the delirium not recognized. I ordinarily use larger doses of cerebral sedatives, as bromides, and smaller doses of aconite than I was accustomed to use at sea-level. Veratrum viride I find comparatively little use for. Digitalis, on the other hand, may be prescribed more freely, especially in those acute diseases tending to enfeeble the heart.

The therapy of the climate of Colorado is scarcely within the scope of this paper and has been so well presented to you by the gentlemen from Colorado who have preceded me, that I will not dwell upon this portion of the subject further than to call attention to the fact, illustrated very many times in my experience, that cases of phthisis frequently do remarkably well in the mountains, at great elevations, when they have failed to improve on the plains, and had all but lost hope of deriving any benefit from that, to them, *dernier ressort*—the climate of Colorado. So many such cases have come under my observation that I am fully convinced that the timidity of advising patients to go to the mountains of Colorado is largely unwarranted. Certain precautions as to clothing, exercise, and habits of life must be attended to as elsewhere in high altitudes, and these are particularly necessary in the mountains. Further, in order to reap the full benefit, the rule applicable to all parts of Colorado must be followed—*i. e.*, the stay must not be intermittent, but prolonged, until the improvement may

be relied upon as more than temporary, and until the reparative process in the lungs is well advanced. Especially is this true for cases which have progressed beyond the first stage. Patients almost invariably gain the most during the winter months.

In considering the benefits consumptives derive from a residence in elevated regions, we naturally ask, To what peculiar features may we ascribe its good effects, the purity, the rarefaction, or the dryness of the air? While I am inclined to answer that the beneficial effects are due to a happy combination of the qualities described added to the possibility of spending a large portion of the time in the open air, and believing that the importance of purity of the atmosphere cannot be ever-estimated, I am of the opinion that the most potent factor is the rarefaction of the air. All portions of the lungs are fully expanded, increasing the activity of the capillary circulation of the lung and bathing the diseased parts with a dry pure air, favoring the absorption of the morbid deposits, while, at the same time, the stimulating qualities of the atmosphere, by improving nutrition, call into action the reserve powers of the constitution, and restore the tone of the system, enabling it to cope successfully with the local disease.

There are one or two very simple rules which all consumptives coming to high altitudes should understand and observe, since, because of the unusual characteristics of the climate, they are so important that neglect of them will retard recovery, and in advanced cases may destroy the slight chance still remaining to the invalid of receiving benefit from the change, and lead to a fatal result.

1. The approach to elevated regions should be gradual and by easy stages, not in these days of Pullman coaches, to spare fatigue, but in advanced cases with limited lung space, and in those with fever and considerable activity of the disease, to avoid over-taxing the capacity of the lung to adapt itself to the rarefied atmosphere. For the same reason the invalid should, for a time after arrival, either take very moderate exercise, or none at all.

2. The residence should be continuous and prolonged.

I am confident, were the first of these rules more generally followed, we should hear far less of the ill effects of high altitudes, and be able to note a larger percentage of advanced cases as improved; and if the second was faithfully observed, there would be more cures and fewer relapses.

DISCUSSION.

Dr. Solly said: Varieties of phthisis and varieties of individuals must be taken into consideration in deciding the question of the value of various elements constituting climate. But *altitude* is one of the positive factors in the climatic treatment of phthisis. The necessity exists to choose the cases, and not to send certain forms to high altitudes. The age of the patient and the condition of the circulation are the most important matters to be taken into consideration. Altitude, by the rarefaction of the atmosphere, produces unpleasant phenomena at first, but these rapidly disappear and improvement of the parenchyma occurs, with an increased vigor of the entire organism, with the throwing off of the diseased condition and a lessening of the chances of recurrence. Cases of "consummate stinginess" of breathing are among those who should be sent to high altitudes. Acute forms will sometimes be benefited, especially if the pyrexia and other acute symptoms are indicative of the acute onset of tuberculosis with night-sweats and high fever. Cases of otorrhœa, laryngeal phthisis, etc., have a better chance of healing.

Dr. Charles Dennison, of Denver, Colorado, said: I regret that the idea should exist that altitude is not a positive factor. It certainly is. The increased measurements of the chest alone prove it. If "phthisis is not favored by a low, nor caused by a high temperature," how about the opposite? With ordinary exercise more than a pint of moisture is exhaled at Cheyenne in winter, and at Charleston in summer, in twenty-four hours. The influence of a dry, cold climate favoring this transpiration is evident. Another influence of altitude is that of the expansion of the cold air when inhaled.

Dr. P. Kretzschmar, of Brooklyn, N. Y., said: I would call attention to the condition of the population of Davos and the Engadine. If a Davosian goes to the lower altitude he is apt to develop phthisis, while health may be regained on resuming life on the heights. The Swiss physicians claim, as the result of their experience, a direct influence of altitude. I do not believe hygienic surroundings are alone the factors in developing tuberculosis.

Dr. Fisk said: In the treatment of phthisis, the conditions which aid in developing the body are the ones most sought for. The high altitudes present these conditions. Here rain and snowfall are limited, enabling the patient to be out of doors a great portion of the days. I consider the stomach should be interrogated closely before sending a patient to Colorado. A dyspeptic will not, as a rule, do well in Colorado. For those who are sent, in order that they may have the full benefit of altitude, etc., prolonged residence is essential. Colorado furnishes the conditions which make prolonged residence possible, as the growing communities make continual residence even desirable.

Dr. Ford, of Utica, N. Y., said: It is easy to get a dry and aseptic atmosphere combined with elevation. Such combinations are numerous. It is not so easy to get the desirable conditions at or near sea-level. Yet at Ventnor-Under-Cliff, in Isle of Wight, these combinations are met at sea-level. The fogs and moisture from the sea are removed from the atmosphere by the intervening cliffs. Experience at Ventnor has shown the benefit even to advanced cases for whom altitude is objectionable. Dryness, asepsis, and conditions for out-door exercise at sea-level are rarely found. But they exist at Ventnor, and the benefits are shown independent of the absence of altitude.

Dr. Bruen said: Improvement of the resisting power of the cellular elements of the blood would seem to be the important end to be sought in the treatment of phthisis, as the cellular elements have been seen to surround and destroy the tubercle bacillus. No climate can do this except as it aids in building up the individual. I believe the benefits of altitude to be purely mechanical. Dryness of soil and air at moderate altitudes, as in Northern Texas, seem to me the desirable conditions. Until more positive data are obtainable of the influence of a particular climate or climatic factor, this Association should hesitate to accept and adopt any definite meteorological condition as *the* one for phthisis.

PUBLIC HEALTH RESORTS

VERSUS

INSTITUTIONS FOR THE TREATMENT OF BACILLARY PHTHISIS.

By PAUL H. KRETZSCHMAR, M.D.,
OF BROOKLYN, N. Y.

That special branch of medical science which interests us most—phthisotherapy—has not kept pace with some other branches of our profession. Much has been done, however, to exclude speculation and empiricism, and to elevate phthisotherapy to a truly scientific basis. All efforts to establish any specific method of treating pulmonary consumption successfully have failed, and even those endeavors to treat the disease by direct local application of appropriate remedial agents, which created so much enthusiasm recently, did not stand the test of experience. Of all the manifold ways which have been employed to relieve pulmonary consumption of its terrible effects upon the human race, none is as old, and none has had more earnest supporters than climatherapy. Hippocrates already considered change of residence as beneficial; Celsus was an admirer of the influence of proper climate upon pulmonary consumption, and advised sea voyages, residence near the coast or in the country, and for those who had not lost much vitality long journeys. Plivius the elder was, probably, the first one who claimed beneficial influence of pine forests in cases of pulmonary troubles; Galen sent his patients to the mountains, and ordered a well-regulated milk diet. Thomas Willis reports that, as early as 1650, the southern part of France was renowned as a country where phthisical patients from England and the northern part of Europe found relief during the cold winter months. Laennec spoke with enthusiasm of the benefit derived from sea air, and died, himself, in a room the floor of which was covered with sea grass. Fuchs, Mühry, and Brehmer established the fact that the inhabitants of regions of a certain

elevation over tidewater are relatively free from pulmonary consumption, and thereupon the claim of immunity from phthisis for certain mountainous districts was based. Dr. H. Brehmer was the first one who established a sanatorium for the treatment of pulmonary consumption, and it is only fair to give him credit for the advance which has been made during the last three decades in developing a strictly scientific and systematic method of treating phthisis in institutions established for that purpose. For much information the writer is indebted to Dr. H. Brehmer, in Görbersdorf, and Dr. P. Dettweiler, in Falkenstein, and he takes this opportunity to thank these gentlemen, and also Dr. E. L. Trudeau, of Saranac Lake, N. Y., publicly for the many courtesies which they have extended to him during his recent visit to their establishments, and since then by frequent correspondence.—The careful and impartial observer must long have arrived at the conclusion, that practical therapeutics have developed to a higher degree in this country than in Europe, and it is, therefore, astonishing that in *some* branches we should so evidently be behind our professional brethren over the Atlantic. Balneology, as well as the medical and therapeutical use of natural mineral water and rational treatment of pulmonary phthisis, are the subjects in which we must admit the superiority of Europe. The most striking example of medical mismanagement of natural springs offers our favorite summer and pleasure resort, Saratoga.

It will hardly admit of any discussion that Saratoga possesses the largest variety of mineral springs in the world, and that many of them may be classified among those which contain as important and valuable combinations as can be found anywhere in nature's laboratory. Nobody will deny that thousands and tens of thousands visit the famous spa yearly, and that many derive benefit from it; this is, in most instances, easily accounted for by the change of surroundings, the pleasant journey to Saratoga, the purity and dryness of the air, the relief from business troubles and from the cares of daily life, and last and least, occasionally dependent upon a well-regulated course of taking advantage of nature's remedy—the mineral waters. While the success of Saratoga as a pleasure and summer resort for the fashionables of all States of the Union *originated*, undoubtedly, through the fact of it having within its immediate vicinity mineral springs well adapted for beneficial use in most of the ailments known to our race, it *now holds* its high position in popular favor more on account of its large and well-equipped hotels with their charming lawns, the beautiful drives it offers over the well-kept streets and avenues—lined with the most

elegant of modern cottages—the horse races, the excellent daily concerts, the freedom and ease of Saratoga life generally, and that important factor in these days, ergo fashion.

The European watering places—such as Carlsbad, Marienbad, Kissingen, Toplitz, Aix-les-Bains, and others—are visited every summer by thousands of Americans in search of restoration to health, notwithstanding the fact that our own mineral waters are, in some instances, superior to, or, at least, as efficient as those found in foreign countries. The question naturally arises, Why, if we have valuable mineral springs in our own country, should so many undertake the long, hazardous, and expensive journey to the European springs? The explanation is near at hand: mineral waters, more than other remedial agents, affect the human organism in the desired way *only* if administered in conformity with proper hygienic, dietetic, and therapeutic regulations adapted to each individual case, and the greater efficiency which is accredited to the springs of Europe does not depend so much upon the chemical combination of the waters as upon the close and careful medical supervision of the daily life of every patient, and upon the regular and medicinal use of the mineral waters.

It may seem that this reference to mineral springs is rather foreign to the subject under discussion now, but the writer could not refrain from emphasizing the great importance of *medical* management of watering places if they shall be classified as health resorts, rather than summer or pleasure resorts. Health resorts for consumptives need medical supervision more than those for other patients, and experience has proven that better results are obtained in the Sanitaria of Görbersdorf, Falkenstein, Reiboltsgruen, and Saranac Lake, than at the open health resorts—such as Mentone, Davos, Nice, Colorado Springs, Aiken, Paul Smith's, or similar places.

I make this statement upon the authority of Drs. H. Brehmer and P. Dettweiler; the former states in a recent letter that over seven hundred patients were treated at his sanatorium during the year 1887, and that 13 per cent. of the whole number, and 53 per cent. of those belonging to the first stage of consumption were discharged cured, and that he considers only such patients as cured who, with the entire disappearance of all the signs and symptoms of pulmonary consumption, show freedom from tubercular bacilli in the sputum for as many as ten consecutive examinations—two being made every week. Dr. P. Dettweiler, who, himself, has been suffering from bacillary phthisis, and had at one time been a patient, and afterward one of the assistants in Dr. Brehmer's sanatorium, says: "If it is of interest to hear the testimony

of a physician who has lived for over fifteen years among consumptives, and who has suffered from the disease for even a longer period, but who is now so entirely cured that even with the greatest care bacilli cannot be found, I formulate my opinion as follows: Under proper sanatorium treatment, if the disease has not made too much progress, and if the treatment is continued for a sufficient length of time, *more than one-half of all cases of bacillary phthisis should be cured, and they will remain so if the patient will live accordingly.*"

The great work of Robert Koch has done much to define our knowledge of the pathology of phthisis; the etiology of the disease has, in some respects, been made clear by it, but phthisotherapy has not derived as much benefit from his discovery and from the works of his immediate followers, as many had hoped for at first.

Neither climatic influences nor medical or surgical treatment, whether applied directly to the diseased lung tissue, or through the general organism, nor increased nutrition, nor open-air camping or resting, nor mountain-climbing, nor the systematic use of baths, douches, mineral waters, or massage has, as yet, enabled us to lay down any reliable guide for the successful treatment of pulmonary consumption, and it is safe to say that we are entirely without means to combat with the bacillus tuberculosis specifically, just as we are still in the dark regarding the knowledge of the *contagious* character of bacillary phthisis in the human race. Discarding all specific medication, it should be our endeavor so to combine *all* remedial forces at our command as to strengthen and invigorate the great complex of the cells—the general organism—and thereby to enable the diseased organ to resist the destructive invasion of the tubercular bacillus. It is our duty to study carefully the means and ways by which this result can be obtained, not only accidentally or occasionally; to find out how the largest number of cases can be cured, not only benefited or temporarily improved. This method of treating bacillary phthisis may be called "eclectic" in the broad sense of the word, and it depends for its success, not only upon the beneficial influence upon the patient's condition, derived from the variety of means to be selected from, but also, and to a considerable degree, upon a careful study of avoiding all such influences, conditions, and circumstances as may bring danger to the enfeebled patient. To carry out this method in all its details, rationally and successfully, it is essential that the physician should have the widest possible control over *everything* that might influence the condition of the patient either favorably or otherwise, and *such* a supervision and control cannot be obtained outside of a well-regulated sana-

torium ; the writer claims that patients suffering from bacillary phthisis will have the best chances for restoration, and will, in a majority of cases, be cured while in the first stage of the disease, if properly treated in a sanatorium.

The decided preference which the writer gives the sanatorium over open health resorts is founded upon a careful study of places of either character, and upon personal experiences gathered while visiting health resorts, both here and abroad. A few striking examples which must necessarily appeal to the intelligence of every one may here be mentioned:

1. It is customary in Davos—the most celebrated of Swiss health resorts—to have twice a week concerts in the large parlor of "Kurhaus Holsboer," the guests sitting in large number at the tables, drinking beer and smoking *ad libitum.*

2. The second day of my stay in Davos I met an old friend, who invited me to visit him at his hotel—Schweizerhof—during the afternoon. On my arrival I found my friend, with three others—all of them phthisical patients—playing cards, smoking, and drinking beer in the guest-room, where others could be found enjoying themselves in the same or similar manner. To my own knowledge the party kept up the interesting and somewhat exciting game of scat from 4.30 to 8.30 P. M., and one or two of them drank as much as five litres of Bavarian beer.

3. A gentleman, who had been in Davos about eight months, and had been improving considerably, informed me that about ten days previously he had joined a party of friends—not patients—and had climbed one of the neighboring mountains, the Schatzalp; that he felt *entirely exhausted* after his return home. The following day he had a slight hemorrhage, and has had fever ever since.

4. In Davos the guests, whether sick or not, smoke in the bar-room, the reading-room, the biliard-room of the favorite Kurhous Holsboer. In Brehmer's Sanatorium smoking is strictly prohibited within the walls of any of the buildings, and even in front of the winter or palm garden, and at those places in the park where the patients congregate.

5. During my recent visit to the Adirondacks I saw a gentleman, who had informed me that he had lost twenty-three pounds within six months, and whose constant coughing plainly indicated the source of his wasting away, standing in front of the bar and drinking one bottle of English stout, the bar-room at that time being filled with from fifteen to twenty guides smoking cheap cigars or poor tobacco from pipes. After drinking the porter the gentleman went from the hot and close

bar-room a short distance through the yard into another building containing the billiard-room, and there he played pool for two hours, he and the other two players smoking. Before retiring the party once more crossed the yard and took another drink. It may be stated that the writer was informed that the gentleman just spoken of had been advised by his physician to drink stout for his health.

6. At Paul Smith's, in the Adirondacks, a place which deserves the reputation it enjoys as a summer and pleasure resort, many faces bear the evidence of pulmonary troubles. But dancing is going on every night in the week, and many young women who visit that famous region of the State of New York in search of restoration to health, indulge. They become excessively hot, breath the dust caused by dancing, and, resting on the arm of the gallant cavalier, they afterward take a walk in the chilly night air.

7. A personal friend of the writer, who stays now at Rainbow, near Saranac Lake, told him that he had been improving right along, until a short time ago, when, after rowing *fifteen* miles, he felt very much exhausted, and that he had been losing ground since then.

Is it necessary to say that such errors as observed in open health resorts could not very easily be committed in any properly conducted sanatorium? Another personal observation may be mentioned here: At the Salle de Réunion, in the Kurhaus of Davos-Platz, an inscription attracted my attention. It reads: "Hilares mox sani" (if one is only merry he will soon be well), and at a like prominent place in the hall of the largest building of Dr. Brehmer's Sanatorium in Görbersdorf, the following words can be read: "Die Patienten kommen nicht um sich zu amüsiren sondern um geheilt zu werden", (Patients do not come here to amuse themselves, but to be cured). These inscriptions speak for themselves—one selected by the largest hotel in Davos, the other one by Dr. Brehmer. They seem to indicate the object and the tendency of both places.

Consumptives, expecting to be cured, should not select resorts where the well find rest and recreation or outdoor sport. A vast difference exists between a general improvement in the condition of a consumptive and the cure of bacillary phthisis. Many cases do comparatively well at either the southern health resorts, with the warm and somewhat moist atmosphere, or the colder mountain places, with the dry and dilated air of high altitudes. But it seems to the writer to be wiser and more judicious to place all such cases as available to treatment, as soon as possible, in a properly located and scientifically conducted sanatorium. The importance of selecting a favorable location

is self-apparent, but to illustrate the wide difference which exists in the death-rate of certain localities, which might either be selected by a patient, if it be left to himself or herself, the writer calls attention to the relative mortality among the natives of the best known southern health resorts of Europe, Nice and Görbersdorf, where the cradle of the institutions for the cure of consumption stood. In Nice the death-rate is 35.5 per mille; and according to Sigmund, one in seven, according to Dippert, one in ten, die of consumption. In Görbersdorf the death-rate is 10 per mille., and during the last twenty-six years only *five* persons—the village having over a thousand inhabitants—or one in fifty-five, died of chronic pulmonary disease.

It is the prevailing opinion within and outside of the medical profession that the presence of consumptive patients at the so-called summer places or health resorts not only interferes with the enjoyment of the well guests, but places them in constant danger of infection, and such is undoubtedly the case in some instances. If, however, the amount of damage done could be accurately ascertained, it would be demonstrated, without doubt, that the phthisical patients suffer in a much higher degree from living among well people than the latter do by the presence of the former. The hopeful nature of consumptives is proverbial, and few, if any, of them, fully comprehend the seriousness of their illness; the company of the healthy brings temptations every day, and more injury is done to consumptives by injudicious friends than a casual observer will admit.

Entertainments of the most innocent nature—such as rowing, tennis playing, the climbing of hills, or even walking long distances, singing, dancing, etc., which contribute much toward the legitimate enjoyment of the healthy, may, and frequently do much harm to those suffering from consumption. It is not claimed that the unfortunate sufferers should not indulge in these pleasures, but if they do so *together* with the strong and healthy, they will be always in danger of overtaxing their enfeebled organism. What may be proper and even beneficial exercise, under the supervision and direction of the painstaking sanatorium physician for patients on the road to recovery, or for those with a good deal of vitality, the same may do harm to patients with more advanced lesions, and it is essential that the limit and the extent of outdoor pleasures and exercise be just as strictly defined as other means are, which are employed by the attending physician—not by the patient's own selection—for the treatment of the disease.

It is admitted that the average American is strongly opposed to submit his own personal freedom and all his doings to the stringent

rules and regulations of a sanatorium, but if we succeed in convincing him of the great benefit which he gains by placing himself under such control, and if he can be made to understand that to be cured he must offer sacrifices, the general antipathy to sanatoria should be overcome. Dr. Brehmer's institution, which is situated near the city of Breslau, about twelve hours' ride by rail from Berlin, is visited annually by hundreds of patients coming from foreign countries, and even Frenchmen, who avoid, as much as possible, the support of German institutions, are there in considerable number.

Among the many difficult tasks to be performed by the sanatorium physician, none is more delicate and of more vital importance than that of educating the patients to a true comprehension of the real nature of their disease, and of gaining their implicit confidence and strict obedience. We hear it often said that the true physician is also a teacher and a minister, and he *must* be both if to be a successful manager of a sanatorium for phthisical patients. Only a man endowed with great patience, self-denial, knowledge of human nature, kindness of heart, coupled with firmness of decision, a man who practises medicine for the love of it, one who has a thorough knowledge of the disease he is to fight, is the fit person to conduct a sanatorium for the cure of consumption.

It is still a disputed question, and one open to discussion, whether it is always wise to inform the patient of his real condition, and in general practice it is usually considered unwise to tell a consumptive the naked truth regarding his case; nor is it advisable in cases of acute diseases for the attending physician to deliver lectures to his patients about their troubles and the mode of action of the remedies employed, but the success of sanatorium practice depends so much upon obedience to the laws of hygiene, dietetics, and physiology, that it is essential the patients should be thoroughly acquainted with the nature of their disease, and without discouraging them in their efforts to restoration to health, they must be made to understand that they are suffering from a disease which, though curable, is of a most serious nature.

To discuss the question of treating pulmonary consumption exhaustively would fill a large volume, and cannot be the object of this paper; the writer wishes only to point in short to the advantages of sanatorium treatment, and how we can best antagonize the tubercular bacillus, if we admit that specific treatment is not available. All our efforts must be concentrated to fight the strongest enemies of consumptives, and most prominent among them are:

1. The disposition to take cold.
2. The weak heart and feeble circulation.
3. The anorexia.
4. The fever.

The peculiar sensitiveness of the lining membrane of the air-passages in consumptives, which depends probably upon a loss of elasticity of the capillaries supplying it, caused by frequent previous inflammation and congestion (Cohnheim), make it at once the *locus minor resistentia* and cause the patients to be decidedly susceptible to otherwise unimportant changes in the surrounding atmosphere. It is hardly necessary to say that most of the relapses which so frequently interfere with the convalescence of phthisical patients, originate from that source, and it is evident that hardening of the system against such morbid susceptibility is an essential part of phthisotherapy. To inform the patients of the value of this part of the treatment is necessary, but it would be a serious mistake to allow them to make their own experiments in that line, or to give certain *general* directions which should apply to all cases. A careful scrutiny of the vitality and the general constitution of each patient is necessary, and a thorough knowledge of the climatic conditions of the locality is one of the first requirements of the sanatorium physician. During the first weeks new cases must be treated with the greatest caution, and daily advice as to the most suitable means to invigorate the system should be given; the residence of the physician within the sanatorium and his constant communication with the patients will enable him to do that. An abundant amount of fresh air, rubbing of the skin with wet and dry towels, the cold douche and baths, are the means employed to obtain the desired result, and are of value in the line mentioned.

Fresh and pure air, the support of all vegetable life, naturally takes the most conspicuous part among the remedies for the cure of a disease which destroys life principally by obstructing the air-pump of the human organism.

If it were possible to supply a sufficient amount of air to oxidize all the venous blood, whether the lung be diseased or not, the greatest advance would be made in prolonging the life of consumptives. The physician who tells his phthisical patients to go in the country and get all the fresh air they can, should, at the same time, remember that such a potent factor, one destined to be of such great service, is apt to produce harm if used without discretion. This is especially true in localities of high altitude, where diminished air-pressure increases frequency of the contractions of the heart.

Permit me to quote from an article read by me, January 27, 1888, before the Section on Materia Medica and Therapeutics of the New York Academy of Medicine: "In connection with others, Dettweiler praises the invigorating influence of pure mountain air and its great value as a powerful agent in the treatment of consumption, but, contrary to the general usage, he does not allow his patients to use it at first without positive instructions from the attending physicians. He maintains that the patient who has, in many instances, been confined to his bed for weeks previous to his journey to the sanatorium, anticipating wonderful effects from pure air, indulges in an excessive use of it." New patients are not permitted to walk outside of the immediate neighborhood, or even remain outdoors for a long time. Under ordinary circumstances the duration of outdoor living is lengthened daily, and the greatest importance is attached to "resting in the open air." It was highly interesting to the writer to observe, during his recent visit to the Adirondack Cottage Sanatorium, at Saranac Lake, Franklin County, N. Y., which is under the charge of our honored colleague, Dr. E. L. Trudeau, that the latter, for some time, had recognized the value of "resting in the open air," and that, entirely independent of Dettweiler's teachings, his patients were in the habit of lying for hours on steamer chairs in front of their cottages. Dr. Trudeau attaches much importance to this method of taking an "air-bath." Dettweiler claims that his experience, extending over a period of more than ten years, has convinced him that immunity against the unfavorable influences of sudden changes in the clmate, diminished cough, increased appetite, and lessened fever, are results obtained by the permanent air treatment. Fortunately for those who cannot, for some reason or another, avail themselves of the benefits offered by sanatorium treatment, the method adopted and tried by Dettweiler and Trudeau can be employed in any hospital or household, and it is to be hoped that it will be. Of course, in due time, exercise in the open air is added to "resting," but the distances are always limited, and the patients are positively instructed to walk slow, body erect, taking deep and full inspirations, breathing through the nose, avoid talking while walking; they are told to rest frequently, and to avoid overtaxation of the heart; they are taught to walk uphill first, so as to have to make the easier portion of their walk, not at the beginning, when they feel strong, but toward the end. Dr. Brehmer's Sanatorium has a beautiful park in front of it, and hundreds of resting-places, a number of garden-houses, and five or six covered pavilions are erected to provide for suitable

resting-places. Where do we find similar arrangements in open-health resorts?

Rubbing of the skin with dry or wet towels, the cold douche, and baths are made use of to strenthen the entire system, and to diminish the susceptibility of "taking cold." The first one of these applications is in great favor with the physicians of Davos, and some of the larger hotels there even have the facilities to administer "the cold douche." It will not be claimed that the rubbing of the skin with dry or wet owels cannot as well be performed while the patients are in bed in a thotel or boarding-house as in the sanatorium, provided the nurse under stands his or her business thoroughly, but the value of the cold douche depends *entirely* upon its proper use, and it should only be applied under the personal direction and in the presence of the physician. The douche must be short, not longer than forty seconds, strong and cold, 45°–50° F., and it must always be followed by a thorough rubbing of the skin with dry towels. It is important, and sometimes difficult, to decide which patients will be benefited by the cold douche, which obtain better results from rubbing with wet towels, and which cannot stand either; only those patients who feel comfortably warm after the use of the douche can derive benefit from its application. It is hardly necessary to call attention to the fact that the proper place for the use of the douche is the sanatorium, and that its use is practically out of question in many health resorts.

The weak heart and enfeebled circulation, which are constant companions of phthisical patients, will be benefited by everything that improves the quality and the quantity of the blood. A special heart tonic is the dilated air of high altitudes; the heart has to do more work, and, like other muscles, it gains strength and power thereby. The same outdoor exercises which the writer considered dangerous if used without proper medical advice—rowing, gymnastic exercise, mountain-climbing, etc.—are of value if considered as *remedial agents* and employed as such.

The most natural channel for improving the condition of the blood is proper alimentation, and *it* necessarily forms a vital part of the treatment of consumption. It is unfortunate that most phthisical patients have been small eaters even before the disease became developed, and that anorexia is present in almost all cases. If we succeed in feeding our patients well and keeping the alimentary tract in good condition, much is gained; but it is the experience of everybody who treats consumptives that *sometimes* our means become exhausted without obtaining the desired result. We all know that in physiological

life the appetite is greater in the cool weather than during the hot summer months, and it has been proven in numerous instances that patients who would and could not eat at home showed a marked improvement if taken to mountainous regions. Drs. Brehmer, Trudeau, and Dettweiler state that it is a frequent occurrence to see patients become real hungry after remaining a number of days in their respective institutions, and all of them attribute this favorable sign to the influence of the mountain air only. A great advantage which the sanatoria possess over open health resorts lies in the fact that they are conducted for no other purpose than to benefit the patients, and that the kitchen and the bill of fare are under the personal control of the physician. In the hotels and boarding-houses three meals a day are the rule; both Brehmer and Dettweiler insist upon five, with plenty of milk taken between meals.

The composition of the consumptive's diet is of vital importance, and it is self-evident that a hotel-keeper is not the proper person to decide which kind of food is most beneficial to patients. The frequent changes in the diet which will often tempt the patients to eat, if otherwise they would not, cannot be expected in hotels, and even the construction of the dining-rooms in a sanatorium is specially adapted to suit the patients; in Brehmer's Institution the air in the dining-room is changed five times an hour by means of the so-called Kosmos ventilation, and its temperature remains cool even during the heated term. The five meals are arranged as follows: about 8 A. M. first breakfast, consisting of coffee, tea, chocolate, or milk, with cakes or rolls and plenty of butter or honey; about 10 A. M. second breakfast, bread and butter with milk *ad libitum*, or bouillon with rolls and cold meat; dinner at 1 P. M, consisting of soup, fish, roast, with a variety of vegetables, salad, and dessert; at 4 P. M. coffee or milk is served; at 7 P. M. supper follows, consisting of soup, warm and cold meat dishes, compote, etc., and at 9 P. M. many patients take another glass of milk. In cases where mountain air, well-prepared food, or even rare delicacies cannot overcome the anorexia, the patients are ordered to take one to two ounces of milk every fifteen minutes, and a large quantity is in that way taken during the day without overloading the stomach at any time. The careful sanatorium physician takes care that his patients receive not only a nutritious diet, in which albuminous food, fats, and carbohydrates are represented in suitable proportions, but he also looks after the peculiarities of those who are not enjoying a good appetite —for much good is frequently done by ceasing the rebellious stomach. Considerable difference of opinion seems to exist about the proper use

and the value of alcoholic stimulants as food: wine, either Hungarian or Rhine, is used with the meals both in Brehmer's and in Dettweiler's Institution; but the latter also gives the patients brandy in small doses during the day and allows the taking of a glass of Bavarian beer with supper. Dr. Brehmer objects strongly to the free use of malt or spirituous liquors, and he advocates that with phthisical patients alcohol must strictly remain a remedy and not become a beverage. No one will doubt that the use of alcoholic stimulants can better be regulated and controlled within a sanatorium than outside of it, and a visit to a bar-room filled with guests smoking, such as the writer mentioned having observed in open health resorts, cannot occur within a properly conducted sanatorium. As to the value of alcohol as a powerful remedial agent, little difference of opinion exists between Drs. Brehmer and Dettweiler; the former says in his recent work on the treatment of phthisis: "When I first used alcohol in the treatment of pulmonary consumption I did so for its beneficial effect upon the heart and the circulation, but more than twenty years ago I found that it also possessed great value in aborting or shortening the chills and reducing the temperature, and that it might properly be classified among the antipyretics." The same author recommends before retiring the administration of two or three teaspoonfuls of brandy in case of night-sweats; but he states that larger quantities of alcohol rather favor the sweating than prevent it. As intimated above, in the Sanatorium Falkenstein alcohol is used more liberally, and Dettweiler goes so far as to say he would give one-half of the entire materia medica for this one remedy; his own words are: "I should be least willing to abandon the use of alcohol in fever, the most potent enemy of the phthisical patient. After many trials and experiments with a large variety of remedies, I will say freely that I would rather dispense with the use of salicyl., antipyrin, or quinine, than with good wine or brandy." The possibility of making habitual drunkards of phthisical patients does exist, but it is reduced to a minimum as long as stimulants are administered according to medical directions—the patients not being permitted to visit bar-rooms or cafés, and there imbibe according to taste and surroundings.

The last subject to be considered is the fever, which, at some time or another, is present in every case of pulmonary consumption, and which is as dangerous to life as the destructive local disease itself. One of Brehmer's rules applying to all new patients is deserving of special attention; the temperature is taken every two hours; an accurate record of the result is kept in each instance. Dr. Brehmer claims

that many cases have come under his observation where excellent practitioners had sent him patients with the record: "free from fever," while the two-hourly measurement showed considerable elevation at various times of the day, a fact which would naturally escape the attention of the attending physician, who is in the habit of taking the temperature once a day—his calls being made generally at about the same time. The most important antidote to the fever is the open air treatment, and the opinion of those who have had opportunities to make observations on a large scale is not divided upon that subject. The value of alcohol has been spoken of, but the application of the ice-bag over the region of the heart is also a favorite remedy in the European Sanitaria, and receives much praise from those who use it. General advice must be especially avoided in regard to the use of the ice-bag, because its favorable influence is most marked if used during the period of the greatest elevation of temperature, and that can only be decided by frequent and careful measurements; it should never be applied for at least a half-hour after the chill. Dr. Brehmer, who has in his possession the carefully recorded histories of over 14,000 phthisical patients, cites a large number of cases, and published the fever-curves, which were treated at Görbersdorf simply by resting, taking alcohol in the form of Hungarian wine and brandy with milk at bed-time, and the application of the ice-bag, all of which showed a normal temperature within three, five, or seven months. Not exactly within the scope of this paper, but very important, nevertheless, is the discussion of the use of antipyretica in phthisical fever. In the writer's opinion we have in antifebrin a sovereign remedy, and while we know perfectly well that we cannot extinguish the burning flames by the use of *any* remedy, experience teaches us, and I am glad to say that my friend, Dr. E. L. Trudeau, fully agrees with me, that antifebrin has a most decided influence upon the temperature, and that under its influence the appetite increases, and the general condition of the patient improves. The writer would raise his voice, however, against the use of large doses, and he seldom administers more than three grains four times a day, and he has seen unfavorable effects from ten grain doses. General rules are dangerous: each case must be treated individually.

Another advantage which sanitaria have over many of the so-called summer resorts, lies in the fact that most of the latter close during the winter, while the institutions for the treatment of consumption remain open all the year round, and the treatment once began may be continued until restoration to health has been accomplished, as best illustrated by the Adirondack Cottage Sanatorium, which has as many

inmates during the winter months as during the summer, while the neighboring fashionable hotels close their doors some time during the month of October, and thereby compel patients to seek other quarters and place themselves under different treatment.

Efforts have been made in this country to establish institutions for the rational treatment of pulmonary consumption. The writer calls attention to the attempts of Dr. H. G. Tyndale, in Manitou, Col., and Dr. J. W. Gleitsman, in Asheville, N. C. It is to be regretted that neither of them succeeded, for, aside from the benefit which such institutions bring to suffering humanity, it must be remembered that careful clinical observations, accurate scientific work, the study of the clinical history, and reliable statistics cannot find a better home than a properly conducted sanatorium. In conclusion, I wish to add my testimony to that of several sanatorium physicians, and say that visits to the best-known institutions, and frequent conversations with patients ave convinced me that the inmates are comparatively happy, an many of them entirely contented to stay for a long time; that, contrary to our natural expectations, the living together of so many consumptives does not produce a depressing influence upon the individual, and that most of them know or learn easily how to occupy the time in such a way as to derive benefit therefrom, and pass through the day without feeling that heavy load—no work—resting upon them.

DISCUSSION.

Dr. Levick: I prefer the cottage system, as illustrated at Saranac Lake, to the huge congregation in crowded sanitaria.

CLIMATE AS AN ETIOLOGICAL FACTOR IN GRAVES'S DISEASE.

By ROLAND G. CURTIN, M.D.,
OF PHILADELPHIA.

If you will kindly follow me, I will try to give you a description of the road that I have travelled in studying the origin of Graves's disease. This study has been carried on without any reference to the opinions of other writers on the subject.

For the development of any new facts, much credit is due to the encouraging stimulus of Dr. Sansom, of London, who, in his very suggestive and admirable work on the *Diseases of the Heart*, shows how any one may add to the stock of facts in medical research by careful observation and experience.

Before graduating in medicine I selected for the topic of my inaugural thesis, Graves's disease, in it giving a report of the histories of three cases, the largest number so far as could be ascertained, reported up to that time, with one exception, Dr. Parry having previously reported seven cases. Since then I have had the opportunity of studying and watching a great number of cases of Graves's disease, having tabulated more than seventy cases, and having had many of them under observation for from fifteen to twenty years. I purpose to give some of my experiences and conclusions, and hope to show you how these conclusions have been arrived at. In the first place Dr. John M. Keating, while a medical student, was studying some cases in the dispensary for the preparation of his graduating thesis. He called my attention to the fact that he had found two patients who stated that they were premature (seven months) children. In a third case, a year or two later, a patient informed me that she also was a seven months' child. As these three were alone in giving such a history this trail was abandoned.

While seeing a large number of cases who applied for relief for various complaints at the Medical Dispensary of the Hospital of the University of Pennsylvania, I was struck by the large proportion of

German and French persons, and their descendants, who were affected with this disease. In looking up the nativity of all the patients attending the dispensary during a period of several years, I found that about ten per cent. of them were from Germany and France; almost all the rest being nearly equally divided between the United States and Ireland. The nativity of the persons affected with Graves's disease, I found in the 28 cases that I had collected in the dispensary, to be as follows: 12 were from Germany and France, 1 from Italy, and the remainder (15) from all other countries represented. I also found that these German and French were almost all from the provinces of Alsace and Lorraine, and some of the cases of the disease of persons born in the United States, were of those whose ancestors were German or French, from the same districts. The foregoing statistics led me to examine, in order to ascertain, if possible, the cause of this frequent occurrence of Graves's disease among these people. The climate I found described as follows:[1]

"Alsace has well-defined boundaries for it embraces the eastern slope of the Vosges and the plane extending along the left bank of the Rhine. Much elongated in proportion to its width. . . . . German Lorraine on the other bank includes the western slope of the Vosges to the north of the Gap of Zabor (Saverne) together with the hilly country which stretches to the Ardennes. . . . . The Nuit and the Moselle which traverse it from north to south.

"The climate of Alsace is not as equable as that of France. It is determined in a large measure by the Vosges, which forms a barrier to westerly winds, and by the broad valley of the Rhine, which is open to the northerly ones. The summers are warm, the winters cold, and sudden changes of temperature frequent. Down in the plane the winds alternate from north to south, but in the mountains they follow the direction of the valleys. Rainfall is far heavier than in the plains, although the number of rainy days is about the same in both.

"In Lorraine the rains are more frequent than in Alsace, and dense fogs impregnated with the vapors rising from the swamps and bogs frequently hang over the country.

"Though unpleasant on account of their peculiar odor, these fogs are said to be not injurious to health. They are certainly beneficial to vegetation, for they protect the sandy soil from the scorching rays of the sun, thus enabling it to retain its moisture."

The population live in an elevated plateau, and on the mountain side about it, but the elevation is not as great as that of many other localities where the disease is less frequent.

[1] The Earth and its Inhabitants, vol. iii. pp. 168–172.

Nothing in the foregoing description of the climate seemed to bear on the subject. After pursuing this seemingly non-productive clew, three families, with two cases in each, presented themselves at the University Hospital Dispensary in three years, and two more at the dispensary of the Howard Hospital; after this I began to inquire of all cases as to the family history. The following data are the results of my investigations:

In the B. family, three sisters (the only children), had unmistakable symptoms of this disorder: one at six, another at ten, and a third at twelve years. Their mother had palpitation and enlarged thyroid at eight years; and her sister the same symptoms at twenty-two, making five cases, in this family, that presumably were affected by the disease.

In the S. family two sisters were attacked, about puberty.

Mrs. H. was attacked at thirty-seven years of age, and her niece at eleven.

Mrs. ——, and her daughter.

The Misses K. (first cousins; whose parents were from Alsace) exhibited unmistakable evidence of the disease at the time of the establishment of their menses.

Two C. sisters, one aged thirteen, and the other aged fourteen.

Mrs. J., aged fifty-four, and her son, aged seventeen.

Mrs. D., aged thirty, and her daughter, aged fourteen.

Miss H., aged twenty, also her aunt (and grandmother, three generations).

The history ascertained from this family, in regard to their grandmother, was that she had a large thyroid, all her life. It was associated with palpitation and a wild expression of the eyes. The enlargement of the thyroid continued until her death, at which time it was noticed, that it had suddenly, almost entirely, disappeared, probably from the withdrawal of the pressure in the bloodvessels. If this enlarged thyroid had been occasioned by cystic disease, this sudden marked change certainly would not have taken place.

Mrs. K., aged twenty-five, and after pregnancy; and her two nieces (sisters), about puberty. The family was quite small, and lived in an elevated valley among the Alleghenies.

Mrs. H.; her daughter (an only child); a first cousin (a man), and his daughter; a child of a female first cousin (a daughter). Another female first cousin's child (a daughter); and a male first cousin's child (also a daughter).

You will observe that in this branch of the family there were actually

seven cases, in two generations; viz., two in the first, and five in the second generation. The father and mother of Mrs. H., and the parents of her first cousins had taken up a residence (after arriving at maturity) among the mountains, where the children were born and raised. This family has quite a large connection, most of them living near tide-water, not one of whom had any symptom of exophthalmic goitre.

Dr. H. C. Wood, of Philadelphia, was called in consultation in the case of a child, six years old, with well-marked symptoms of acute Graves's disease. He lived six months after the first symptoms of ill health, dying of this disease. The child's father, a judge, and an observing one, informed Dr. Wood that another child had died, at an early age, with exactly the same symptoms.

Dr. Dellenbaugh, now of Cleveland, Ohio, while formerly practising in Philadelphia, had two patients, sisters, who had marked Graves's disease, which appeared about the first menstrual epoch.

Dr. G. W. Guthrie, of Wilkes-Barre, Pa., has two patients (a mother and daughter) afflicted with this disease.

Dr. J. Madison Taylor, of Philadelphia, has reported two patients (sisters) with this affection.[1]

Here you will see that in the cases which I have examined within the last ten years, I have found eleven families, each presenting more than one case; and four other families have been added, who were under the care of my medical friends. In summing up I find an aggregate of forty persons of Graves's disease, in fifteen families; these cases, I think, prove that the disease is hereditary. Can we account for the great prevalence in certain districts, like Alsace and Lorraine, on the theory of heredity? I think we can.

Residence in an old province, in a valley or mountain region, where the population is circumscribed or restricted by natural or physical barriers, or both, would tend to limit the population in their marriage selections to their own people, causing a tendency to "breed in and in," so that at the end of centuries, "the whole flock might be tainted by a few black sheep." In the case of the last two families reported in the list of those representing the hereditary phase of the disease,

[1] After reading this paper, Dr. Sansom, of London, informed me that he had two patients, sisters, with well-marked Graves's disease, coming on about the age of puberty. In addition, Dr. R. H. Hamill, of Philadelphia, states that he has two cases in the same family, with a history also of their grandmother having had the same affection. These two families, added to those already reported in my paper, sum up 45 cases in 17 families.

they lived among the Alleghenies, and from observation the disease seemed to be aggravated by the mountain residence.

What would be the probable influence of altitude upon the development of the disease under consideration?

It has been found that the atmosphere of elevated situations has a decided effect upon the nervous system. In order to show you the opinion of persons living in such localities, I will quote from Dr. Charles Denison, of Denver, Colorado, in his book on *Rocky Mountain Health Resorts*, published in 1881. In speaking of the influence of five or six thousand feet of elevation on newcomers, he says: "The first sensations are agreeable, the influence of the air being described as exhilarating." Again, in speaking of nervous complications, he states that "the more acute or severe the nervous symptoms, the more of an aggravated nature is the effect of elevations." Further, he writes: "From what has been written of the stimulating or electric nature of the air at this altitude, it would be apparent in what manner some sensitive organizations might be influenced by the too stimulating atmosphere for them."

Dr. S. E. Solly, in his book on the *Health Resorts of Colorado Springs and Manitou*, mentions that "There is a greater energy of each of these as primary effects; these are strongly marked in Colorado. Persons first coming here with whom the climate tends to agree, usually feel exhilerated, freqently speaking of the air as champagne, depression of spirits vanishes, and they indulge in extravagant eulogies upon the scenery, etc."

I have seen the disease suddenly developed, and in other cases also increased by fright, grief, an attack of malaria, a fractured leg, dysmenorrhœa, an attack of indigestion, and other constitutional and mental disturbances. It seems quite possible that anything tending to excite or disturb the quiet of the nervous system, might develop the disease, which, under other circumstances, might have remained in a quiescent state. Following this argument, it would appear that a mountain residence is unfavorable, for developed cases, or even for persons who have only a hereditary tendency in this direction. The two families whom I observed, and have here reported, who lived in the Allegheny Mountains, seem to furnish evidence of having been influenced by their place of residence, for in so far as observation could reach in the entire family for several generations, no traces of development of the disease could be found among other branches occupying the low lands.

These families included all the cases that I observed in the elevated region before mentioned.

CONCLUSIONS.—From the foregoing facts we are, I think, forced to the belief that this disease *is hereditary.* Probably heredity is the *predisposing* cause in all cases.

Secondly, I feel well satisfied that *an elevated region is one of the exciting causes of Graves's disease.* Hence, I do not think that a person suffering from this ailment should be sent to a high region; neither is it safe for a person with a hereditary tendency in this direction, to make a home on a high elevation.

I am now sure that many of the so-called cases of bronchocele are cases of imperfectly developed, and unrecognized Graves's disease. I think that in all cases of enlargement of the thyroid, where the tumefaction of the gland markedly increases and decreases, it is the result of Graves's disease; and I am satisfied that the reason such a variety of remedies is extolled by different authors, for the thyroid enlargement of Graves's disease, is that the disturbing nervous influence, which causes an increase in the size of the gland, subsides upon the removal of the cause of excitement. The remedy receives the credit for the decrease. In my own experience some cases of Graves's disease have been treated by painting the thyroid with iodine; internal administrations of iodoform, iron, and many other remedies. The remedy used has received the credit of relieving the patient, when, as I have afterward found, the change has been due to the quieting of the nervous system; a regaining of the equilibrium after the removal of the cause of disturbance, which might be an attack of indigestion, grief, fear, or other emotional cause, pregnancy, and incipient or deranged menstruation, the menopause, an attack of malaria, etc.

Having seen a large number of walking cases in dispensaries (about 24,000), among them I have found very few cases of cystic disease of the thyroid (sometimes called colloid goitre), and in these cases of simple bronchocele, the size of the gland was found to be not very greatly increased.

Many of the cases which have been under my observation were supposed to be simple goitre, inasmuch as they responded promptly to local treatment; they have, however, afterward proved to be Graves's disease, as shown by the later full development of all the symptoms. I have also found that the symptoms often improve rapidly while taking a placebo.

Since writing my conclusions, I have observed a case in point reported by Dr. S. E. Solly, of Colorado Springs, in a paper read before

the Colorado Medical Society, in 1877, entitled the "Influence of Climate upon the Nervous System." The doctor states:

"A case of exophthalmic goitre came under my care at Manitou, last summer, in a lady from Kansas City. She remained six weeks, during which time her special symptoms got worse, though her general health somewhat improved. She was troubled whilst here with insomnia, somnambulism, and attacks of palpitation. She found relief from these on her return home."

DISCUSSION.

Dr. W. H. Geddings, of Aiken, S. C., said: As regards the influence of altitude in Graves's disease, I might mention a case which I treated at Bethlehem, N. H., which showed the bad effects of altitude in increasing the severity of the case.

Dr. S. A. Fisk, of Denver, Colorado, said: I recall three or four cases which I treated at Denver. One a girl of sixteen, with an anæmic mitral murmur, presenting the kind of symptoms constituting Graves's disease, which yielded to tinc. ferri chlor. Two Swedish girls relieved with iodide of potassium, and iron with electricity. I do not think the altitude of Denver derogatory to such cases.

Dr. James J. Levick, of Philadelphia, said: I look upon these cases as cases of nervous diseases. Heredity has no doubt a similar influence, as in other neurosal diseases. I recall a case of mother and child. The mother developed the disease as a sequence to a severe fright; had it for a short time and rapidly recovered. The case of the son, a lad of sixteen years, also resulted favorably.

AN ENVIRONMENT EXPERIMENT REPEATED, 1888.

By E. L. TRUDEAU, M.D.,
of Saranac Lake, N. Y.

In a paper read before the Association at its last session some experimental evidence was adduced which tended to show that, at the first step of artificial tubercular infection, the pathogenic properties of the tubercle bacillus and the natural resistance of the tissues are so closely balanced that infection may often be prevented, and always hastened by the nature of the environment in which inoculated animals are placed.

In order to complete this research, a confirmation of the evidence already obtained as to the favorable influence of a good environment over the course of the disease has been sought for, while two points relating to the experiment in which the rabbits were allowed to run wild and failed to become infected, have seemed to merit further study. The first relates to the quantity of virus made use of, and the second to the permanancy of the beneficial influence exercised by favorable surroundings. Whether the animals would have escaped equally well had the amount of bacillus-bearing fluid injected been large and whether their apparent recovery was permanent or only temporary, are questions to which an answer has been sought by a repetition of the former experiment with such variations only as would tend to throw light on these points.

On June 10, 1887, six full-grown, healthy rabbits were inoculated in the right lung with a quantity of a pure culture of the tubercle bacillus, as nearly as could be estimated, at least twice as large as that made use of in the experiment of 1886. They were at once turned loose on the same island, and supplied with an abundance of food throughout the entire summer. After being permitted thus to run at large for four months, three of them were killed, while the remaining three were placed in a box and spent the following four months in confinement in a sandy pit, on a moderately restricted diet. At the expiration of four months they too were killed, and their organs examined.

LOT NO. 1.—Killed as soon as removed from a favorable environment. In the first rabbit no lesion whatever, was observed; in the second extensive and advanced tuberculosis of both lungs, with caseation at many points in the injected lung, was noted; while in the third, a thoroughly localized lesion, consisting of a small fibrous cyst, containing hard putty-like material and attached to the costal pleura at the site of inoculation, was the only disease present. In the centre of this fibro-calcareous nodule a few bacilli with spores were demonstrated by staining. All the organs were sound and the animal was loaded with fat.

LOT NO. 2.—Killed four months after removal from favorable to less favorable surroundings. In the first animal examined, a small localized cavity in the middle lobe of the right lung marked the site of injection. The connective tissue forming the walls of this little excavation was so thick as to make it resemble a cystic tumor, in the centre of which were a few drops of a turbid fluid. The lung tissue in the immediate vicinity was normal and no enlarged bronchial glands were detected. The other organs were all healthy and the general nutrition excellent. The fluid from the cavity stained and examined under the microscope showed a few bacilli, most of them full of spores, and from a portion transferred to blood serum, a pure culture of the tubercle bacillus was readily obtained. In the second rabbit all the organs were perfectly normal, in the third the following lesions were noted. The right pleura, especially on its mediastinal aspect, was studded with small growths, some of them nearly as large as a split pea, of extreme toughness and light yellowish color; on section they were found composed of a fibrous capsule of varying thickness containing material of the consistency and color of dried putty and partly calcareous. Under the microscope a few bacilli were made out in these nodules, and plants from the same source on blood serum resulted in a pure culture of the tubercle bacillus. The lungs were perfectly free from disease, the other organs were sound, and the animal was in good condition.

A comparison of the experiments of 1886 and 1887, made under precisely the same conditions, except that in the latter double the quantity of virus was injected, gives the following results. In 1886, for five rabbits, one death occurred from progressive tuberculosis, and four entirely escaped infection. In 1887, out of six animals, one at the autopsy showed advancing diffuse pulmonary tuberculosis, two failed to become infected, and three (or one-half) presented localized and arrested primary lesions. The beneficial influence produced by a good environment on the course of the tubercular affection, as evinced by the arrested lesions of the last rabbit, seems to have been maintained for four months in spite of their removal to less favorable surroundings.

The dormant virulence of the germs, and the dangers which still

threatened are shown by the readiness with which these microbes and their spores spang into activity when planted on a suitable culture medium.

From a comparison of the two experiments, it would appear that the amount of virus which enters the economy at one time is an important factor in determining infection, and the influence of a favorable environment is emphasized, not only by the entire freedom from disease presented by two of the rabbits, but by a careful study of the arrested lesions of their mates. The lungs of these animals bore testimony to the effectual efforts of nature to localize the mischief, and in none of them were secondary lesions present. In two a fibrous sac contained all that remained of the necrotic tissues and the bacilli, and formed an efficient barrier between these still dangerous elements and the healthy parts by which they were surrounded; in the third the injection passing between the upper and middle lobes had evidently entered the pleural cavity alone and acted on a much larger surface; the calcified and fibrous nodules which studded the pleural surfaces marking the numerous foci which had been successfully localized.

The absence of any fresh outbreak of tubercular disease noted at the autopsies of the animals placed for the last four months in less favorable surroundings, is evidence that the conservative reaction of the tissues against the bacilli tended ultimately to bring about complete recovery. The danger of relapse could not, however, be said to have passed, for the encapsulated bacilli grew readily when released and planted on a suitable culture medium.

The autospy room constantly demonstrates that infection is often arrested when the primary lesions are restricted, while death almost invariably follows when they become more advanced. Vibert recently, while making 131 autopsies at the Paris Morgue on persons who had come to their death by violence while apparently in good health, noted in twenty-five—that is, in more than nineteen per cent.—the presence of some slight tubercular lesion. In seventeen of the twenty-five a few calcareous and fibrous nodules remained as the only evidence of an unsuspected and arrested tubercular process, but in none were the pathological changes in the lung extensive. Recovery often follows the operations now undertaken for tubercular peritonitis, though it is evident that all the infectious material cannot be removed. Dogs when injected subcutaneously with a moderate amount of a culture of tubercle bacilli, develop only localized foci, show no deterioration of health, and finally recover completely, but their resistance to the disease can be overcome by the inoculation of larger quantities of the

virus. Koch, for a long time, failed to infect rats, but finally succeeded by repeated introduction of more liberal amounts of the culture.

The doctrine of the unity of tubercular virus may be said to derive support from a consideration of the proof offered by both experiments taken collectively, for although the amount of virus injected proved a most important factor in determining infection, whether the animals escaped entirely or died of progressive tuberculosis, whether purely localized disease not incompatible with life or widely differing generalized and progressive pathological processes were induced, seemed to depend not on any variation in the nature of the virus injected, which was the same in all cases, but on an increased or diminished degree of resistance induced in the tissues through the influence exercised on the vitality of the animal by extremes of environment.

All attempts at the direct destruction of the tubercle bacillus in living beings by germicides have so far proved fruitless, while the records of the autopsies made by Vibert, Councilman, and others, as well as the evidence offered by the present research, furnish proof that the tissues themselves can, under certain conditions, either limit the destructive action of this microbe or even entirely rid themselves of its presence. The best promise of success in the management of tubercular affections for the present, therefore, lies not so much in the search for specific germicidal methods of treatment as in careful study of all those measures which tend to increase the vital resistance of the infected individual. One of the principal objects of this Association is the study of those conditions of light, air, and habitation best adapted to bring about, in the human subject affected with tuberculosis, arrested lesions such as have been described above. That it is possible artificially to produce this result on animals by these simple means alone should be an incentive to a thorough discussion of those climatic and hygenic conditions which go to make up a favorable environment.

[Lungs illustrating arrested lesions in the artificially induced tuberculosis of rabbits were presented for inspection.]

DISCUSSION.

Dr. Pepper: I am much interested in Dr. Trudeau's continued investigation in these lines of research. This paper constitutes, with the previous one from the same author, read at our last meeting, most positive data concerning a most interesting subject, viz., the restriction of the activity of the tuberculous virus. This is illustrated in our experience by the occurrence of phthisis under bad hygienic environment, which is relieved by habitation in aseptic environment. Cases occur whose sputa indicate the pres-

ence of tubercle bacilli, and yet who resist the encroachments of the virus, and even ultimately recover. The question of difference in virulence in tubercle when this organism is so minute that its life history is most difficult to study, is one whose solution is not an easy one. The experiments of Dr. Trudeau exhibit the influence of environment almost exclusively. The question of the personal resistance makes the question a most complicated one. Inherited differences, anatomical or chemical, complicate the question still more. Still, in the human being, as in the animal, the influence of environment is vast.

Dr. Sansom, of London: I do not question if the tubercle bacillus is the *vera causa* of phthisis; but I do question if it is the cause of the dangers of tuberculosis. In tubercular peritonitis, recent experience has shown that the peritoneum may be studded with tuberculosis, and yet complete recovery result, showing that tubercles may be cured. The vital conditions of the *bacillus tuberculosis* are not wide, but very limited, and we may ask ourselves the question, The *danger*—is it not from other septic organisms? The putrescible matter found in a tubercular lung is a very hot-bed of numerous organisms. The tubercle bacillus may live its life and need not, except under special conditions, become dangerous. But under special conditions *epiphenomena* of a septicæmic nature, resulting in the formation of a cavity, in pus-formation, in sepsis, etc., induce the serious features and constitute the danger in an attack of tuberculosis. And, again, may not the beneficial influence of climate consist in preventing these ulterior phenomena?

Dr. Carey Thomas, of Baltimore: Why do we not endeavor to secure at lower altitudes, near home, sanitaria suitable for those who are unable to get far away?

Dr. H. F. Williams, of Brooklyn, believed the bacillus of acute miliary tuberculosis to be more virulent than the ordinary forms.

Dr. P. H. Kretzschmar, of Brooklyn, referred to the beauty of the specimens presented by Dr. Trudeau, and of their great value in connection with the paper, and moved that they be referred for publication in the *Transactions* by means of illustrations. Carried.[1]

Dr. Councilman, of Baltimore, by invitation, said: A great deal of light may be thrown on this subject by the study of the anatomical features of the infected tissues. There are three factors concerned in determining the lesion:

I. Number of bacilli.
II. Manner of entrance.
  In lungs:
    a. Along bronchi, thus aspirated to various portions of lungs.
    b. Along lymphatics.
    c. Along bloodvessels.
III. Resistance of tissues to their encroachment.

[1] This was decided by Dr. Trudeau to be impracticable owing to the difficulty of obtaining photographs of the specimens which would do them justice.

FURTHER REMARKS ON THE CIRCULATORY CHANGES AT HIGH ALTITUDE.

By FRANK DONALDSON, Jr., B.A., M.D.,
of BALTIMORE.

There is an ever-increasing disbelief in the power of sprays or of inhalations to arrest or cure true pulmonary disease. The disuse of such apparatus forces the physician to depend upon the climatic as the only rational treatment of such disease. Now, it is to high altitudes and to a comparatively rarefied atmosphere that consumptive patients are sent. While the benefit actually received is great, on the other hand, in a certain proportion of cases, removal to high altitudes is attended with danger to life entirely unconnected with the immediate lung disease. Alarming attacks of dyspnœa and of cardiac failure occur in high altitudes.

A year ago I called attention to the fact and endeavored to explain this cardiac dilatation and failure. I wish now, very briefly, to describe the physiological changes in the circulation at high altitude. I would consider, first, the influence of the normal respiration movements on the circulation under what we may take as normal conditions, viz., a barometric pressure of 750 millimetres of mercury.

As to the influence of the normal respiratory movement upon the circulation. In any given inspiration the chest cavity is enlarged, negative pressure is created in the thorax; not only the lungs, but the right side of the heart, and the intrathoracic portions of the systemic veins, are expanded in consequence, and the blood is drawn toward the great veins and right side of the heart. Such being the general effect of negative intrathoracic pressure, what is its influence upon the blood-flow through the lungs, upon the intrathoracic vessels, and finally upon the systemic circulation?

De Jager holds that, though the negative pressure is exerted equally on the pulmonary artery and vein, the effect upon the blood in each is very different, for the walls of the pulmonary artery are much thicker than those of the pulmonary vein, and any want of pressure

would be transmitted through them upon the blood much less readily. Again, the walls of the pulmonary artery are normally distended by a pressure of from 30–40 millimetres of mercury, and so the slight increase of negative pressure occurring during inspiration would probably have little or no effect in distending the pulmonary artery. On the other hand, the blood in the pulmonary vein is under little, if any, positive pressure, and so diminution of pressure would distend its walls considerably. De Jager, therefore, holds that we would have the normal conditions during life more nearly represented if, in an artificial thorax, the pulmonary vein should be exposed to the same negative pressure as that expanding the lungs, while the pulmonary artery was left under a constant pressure of one atmosphere, for instance.

Experimenting in this way, he found that the stream velocity (the amount flowing from the pulmonary vein in fifteen seconds) is markedly greater during *expansion* than during *collapse;* the effect then of normal inspiration, on the whole, is to increase the quantity of blood flowing through the lungs, probably by increasing their capacity, and thus diminishing the resistance to the flow. De Jager, in his second paper, gives the final opinion that "the respiratory waves in the blood pressure in the dog in normal quiet respiration are caused by changes in lung circulation. The first sinking of pressure at the beginning of inspiration is a capacity curve—*i. e.*, due to increased capacity of the lung vessels; the following rise, a stream velocity curve"—*i. e.*, caused by an increased flow through the lungs. In a like way, the rise at the beginning of expiration is a capacity curve—*i. e.*, owing to a diminished capacity; the succeeding fall, a stream velocity curve, due to diminished flow through the lungs.

Second. *The influence of respiration upon the heart and great vessels.* The first effect of the negative pressure of inspiration is a diminution of pressure on the heart and intrathoracic vessels, and a consequent *sucking* of blood into the right side of the heart, which in turn is sent through the increased area of the lung vessels to the left heart, and thence to the systemic circulation, causing a rise of pressure. Another important element in the respiratory waves of blood pressure is the change which takes place in the intra-abdominal pressure in inspiration. Luciani and Schweinberg maintain that the descent of the diaphragm causes increased abdominal pressure, which assists the rise in arterial pressure, 1st, by driving the blood out of the abdominal veins toward the heart; 2d, by compressing the abdominal arteries. Another cause of increased pressure during inspiration is the increase

of heart rhythm, due to a rhythmic automatic discharge from the cardio-inhibitory centres, this discharge depending in some way on the rhythmic discharge from the neighboring respiratory centres.

The effects, then, of the negative pressure following inspiration are, an increased blood-flow to the large intrathoracic veins, and to the right heart an increased heart capacity, especially of the right side; an increase of intra-abdominal pressure, forcing onward the blood; an increase of capacity in the pulmonary veins; an increased blood-flow through the lungs and to the left heart; an acceleration of the heart rhythm; and, finally, an increase of systemic arterial pressure.

Such are the circulatory changes in ordinary respiration. How is the cycle changed at high altitudes?

First. The great factor in the greater circulation is the negative pressure exerted during inspiration.

Although it is generally so asserted, there is *no* increase of negative pressure in the chest-box at high altitudes, for, at any given height, say 10,000 feet, the inside and outside of the chest are subjected to the same—though lessened pressure—and there is *no increase in the depth of inspiration*,[1] and consequently *no increase of negative pressure*, and no increase in the blood flow to and through the lungs.

Second. At high altitudes there is no change in the peripheral circulation.

It is plain then that any disturbance of the circulation at such an altitude (10,000) would not be caused by any increase of negative pressure. By what then is the circulation disturbed? *By the diminished pressure upon the heart and great vessels.*

As is well known, there is an intra-pulmonary pressure, *i. e.*, the lungs ordinarily press upon the contents of the chest cavity with a pressure equal to 754 cm. of mercury. Now, at 10,000, the pressure on the heart and great vessels would be only 495 cm. of mercury.

What is the physiological effect of this lessening pressure?

1. There would be a greater or less dilatation of the great veins with consequent increased blood-flow from the periphery, and a probable increase of capacity of the right heart.

2. There would also be a dilatation of the thin-walled pulmonary vein, for, as we have seen, there is little if any positive pressure within its walls, and want of pressure would be immediately felt.

3. On the other hand, the pulmonary arteries would not be affected,

[1] Prof. Martin and the writer amply confirmed this statement in the course of experiments with the pneumatic cabinet. See N. Y. Med. Journal, May 15, 1886.

two factors contributing to prevent, viz.: Their comparatively thick walls and the abnormal positive pressure.

4. The left side of the heart would not be affected by the lessening of pressure.

How then would the varying factors affect the circulation at high altitude?

As we have shown, there would be a considerable increased blood-flow to the left heart. Now, we know that to preserve the equilibrium of the circulation, as much blood must flow from the pulmonary vein at each beat as comes to the right side of the heart. We have also seen that in high altitude there is no increase in the size of the pulmonary structure, nor in the capacity of the lower capillaries; what then prevents the backing up of blood in the left heart (which, as I showed last year, is the cause of the cardiac failure at high altitudes)?

The increase in the size of the dilatation of the thin-walled pulmonary veins by which such an increased quantity of blood is sucked through the lungs at each inspiration, and sent on to the left heart; this alone may be sufficient to prevent a breaking up of the blood in the right heart, and to preserve the equilibrium of the circulation.

In view of the above facts it is plain why, at high altitudes, so many persons suffer from dyspnœa and cardiac failure.

There must be a considerable disturbance of the normal circulation, which must most seriously affect patients with any form of cardiac or pulmonary weakness.

Finally, the key to all disturbances of the circulation at high altitudes may be found in the lessening of the normal pressure with which the lungs ordinarily press against the heart and great vessels.

CONDITIONS WHICH TEND TO RENDER THE ATMOSPHERE OF A LOCALITY ASEPTIC.

By J. T. WHITTAKER, M.D.,
of Cincinnati.

Conditions which tend to free, or keep free, the air from pathogenic microörganisms, is the construction I put upon this subject that it may have medical as well as surgical consideration.

In this consideration the subject is brought into proper limit by study of the question, What pathogenic microörganisms do or may exist in the air, first outside, second inside the walls of houses? The older writers derived the cause of most diseases, certainly of most infectious diseases, from the air. The vague term "telluric influence" constituted a kind of refuge for everything inexplicable, including syphilis. With the discovery of the infusoria by Leeuwenhoek, 1675, came the birth of the germ theory, to give rise to the wildest conceptions regarding the infection of the air. The air was supposed to swarm with germs of animal nature, something in the form of moths, armed often with beaks and claws, individual varieties of which produced individual diseases. It was seriously proposed in the seventeenth century to drive them away during an epidemic by the noise of trumpets and the thunder of cannon, just as the people of our day, as much as in the days of the Athenian plague, attempt to frighten them with cannon or burn them with bonfires in public squares. Less fantastic, though nearly as extravagant, was the view that the myriad motes of the sunbeam were germs or carriers of germs of disease.

The natural reaction which dissipated for a time all belief in a *contagium vivum* did not detract from the air as the chief element in the production of infectious diseases. For telluric influences and swarms of animals were substituted electric currents, ozone proportions, volatile emanations, vapors, gases, etc., views which are not without advocates in very recent times. Thus, Surgeon-General Hunter of the British Army is inclined to ascribe the cholera of India, in 1884, to the state of the air. "When the epidemic was at its height," he says

in his second report, "on the 23d of July, a very peculiar condition of the atmosphere was observed; a yellowness of the air, somewhat of the nature of a fog; and it was quite calm. The sparrows, it was observed, had deserted the place and did not return until July 26th."

With the reintroduction of the germ theory upon the basis of a fact, to wit, the discovery of the spirilla of recurrent fever by Obermeyer, 1873, and the general adoption of it which gradually followed the discovery of the tubercle bacillus by Koch, in 1882, the *rôle* of the air as a reservoir of microörganisms became more prominent than ever. Inasmuch as this disase could be imparted to animals by inhalation experiments; inasmuch as the germs of the disease from their principal localization are known to be inhaled; and inasmuch as the lungs constitute a vast absorbing surface exposed to the air at all times: it was not unnatural to believe that all the infections could be contained in and received from the air. The majority of teachers, writers, and clinicians believed and maintained that cholera, typhoid fever, and dysentery, for instance, entered the body through the avenue of the lungs.

So long as microscopy and chemistry constituted the sole means of examining the matter deposited from the air there could be obtained no precise knowledge, which became possible only with isolation of its particles and cultivation of them in various soils. These investigations, which are necessarily of recent date, have nevertheless already disclosed the fact that the air, as a rule, when compared with the water and the soil is singularly free from pathogenic microörganisms. In fact, the only pathogenic microörganisms as yet definitely discovered and established by inoculation experiments are the ubiquitous staphylococcus pyogenes aureus and the streptococcus of erysipelas.

We are forced, therefore, to reach by elimination the diseases whose causes may exist in the outside air. We may exclude thus, first most, if not all, the eminently contagious diseases whose infectious principle is given off from the body directly or indirectly. Thus, it is not probable that smallpox, scarlet fever, measles, typhus fever, relapsing fever, aside from accidental direct contact with cases, are ever contracted in the open air. Cholera, typhoid fever, and dysentery, since the demonstration of their cause in drinking water, positively in the case of cholera and typhoid fever, presumptively in the case of dysentery, have lost all connection with the atmosphere outside or inside. Should the meningococcus prove to be the cause of cerebro-spinal meningitis this disease will take its place with croupous pneumonia as a house disease, which is certainly the case with tuberculosis—no case of which was

ever contracted in the open air. The tendency of our day is to regard acute articular rheumatism as a mycosis whose cause lies inside and not outside the walls of the houses. Erysipelas, if not directly inoculated, falls upon wounded surfaces from bedding, clothing, house furniture, or walls from which its microörganisms have been directly scraped.

Diphtheria and croup stand on debatable ground, with the probabilities, on account of demonstrated infectiousness, strongly in favor of inside transmission. Yet it is not impossible that the diphtheria of fowls may be a source of infection of man. Since Stöhr has shown that the epithelium of normal tonsils presents openings, stigmata, or holes through which white blood-corpuscles pass constantly into the mouth the way is opened directly to the blood for the passage of outside germs.

The non-contagious infections, the group characterized as miasmatic diseases, the number of which grows gradually less as the causes of the infections become accurately determined, remain as the sole affections whose cause exists in the outside air in quantity sufficient to produce infection. Preëminent among these is the variety called bad air, malaria; and with the malarias may be associated influenza, hay fever, possibly pertussis and yellow fever, the last of which differs markedly from the rest in the fact that it must be introduced by a case of the disease. Hence it is not improbable that the determination of the exact cause of this disease will remove it from the miasms altogether. The infective principle lives, apparently, in the discharges, and is largely localized in the liver, but seems to require some transformation in bilge-water, bedding, or other soil, before it becomes actively infectious

The statement is here superfluous, that the miasmatic diseases proper originate not in the air but in the soil, whence the cause is lifted and disseminated by currents of air.

Thus it is evident that the cause of but few, and these by no means the fatal diseases, actually exists in the outside air.

Direct examination of the air by even the first means employed, revealed the fact that the quantity or number of microörganisms in it varied greatly in different places. The air of the country is more free than that of the city, in the proportion, according to Miquel, of 1092 to 9750 to the cubic metre, at Montsouris and Paris; or according to Freudenreich, of 300 to 2400, about and in the city of Berne; the air of the city parks, according to Frankland, containing more microörganisms than that of the country about London. Microörganisms of all kinds

are heavier than air, and, consequently, sink in a tranquil atmosphere, to abound most on the surface of the earth. Thus, Miquel counted in the air at the top of the Pantheon but 364 germs to the metre, and Tyndall and Pasteur found the air "optically pure"—that is, entirely free from microörganisms—at the top of the Alps. As a sample of the microörganisms of the air may be mentioned the results of an examination by the two Franklands, who found ten varieties of micrococci, twelve bacilli (among which were the hay bacillus and the bacillus prodigiosus), two ferments (one of which was the rosa-hefe), one mould, and yellow and orange sarcinæ. Hesse demonstrated the rapid gravitation of all microörganisms in air which was comparatively still, and observed the much more rapid gravitation of bacteria than of moulds and ferments. Petri shows thus that entirely different results are obtained in aspiration studies, which take the air above or in circulation, and plate studies, which collect from the surface or at rest. In aspiration observations moulds and ferments abound, while in plates bacteria predominate. Hence, to obtain reliable results, both methods should be employed at once.

Marked diminution in the number of all microörganisms follows a rainfall which washes them down, or a tornado which sweeps them away, or a fall of snow which prevents their dissipation by the wind.

Absolute outside air is met at the surface of the earth only upon the high seas, and repeated observations, most accurately by Fischer on the steamer "Moltke," have shown that at a distance of 70 to 120 sea miles from shore, except in the presence of land winds, the air is nearly or absolutely pure. Thus, all microörganisms reaching absolute outside air are diluted to the infinite and lost.

Very different, in this regard, is the constitution of the air within the walls of houses. The number of microörganisms in the outside air sinks to insignificance in comparison with the air inside the habitations of man. Thus, in Miquel's own house there were in summer, in each cubic metre, 49,800, five times as many as in the street outside, and in winter, owing to diminished ventilation, 84,500, nearly ten times as many as in the street. Dennis found that not a single germ developed upon sterilized glycerine slides exposed off the bow off a ship; but five or six in ten days upon two slides exposed on the promenade deck under free ventilation of air, whereas upon one in the stateroom exposed for but fifteen minutes, there formed in eighteen hours five hundred points, or beginning colonies.

Microörganisms multiply in houses in proportion directly to the number of inhabitants, and inversely to the number of rooms or amount

of inhabited space. Cornelly, Haldane, and Anderson published tables showing the impurity of houses of one room compared with those of four or more. Diseases stood in exact relation with the number of inhabitants. The mortality of tuberculosis is greater in houses of one and two than in those of three or more rooms. Neumann observed of the air at the hospital Moabit, examined by Hesse's method, that germs of all kinds were most numerous in the morning after sweeping and after the patients got out of bed—80 to 140 in 10 litres of air, when they gradually reduced in number until evening, at which time they numbered but 10 in 60 litres of air, the average number present in empty rooms The gradual reduction of microörganisms in the course of the day in a still but peopled room is due partly to the subsidence of the heavier germs, but chiefly to the gradual incorporation of them into the lungs. Numerous observations by Tyndall, Grancher, Charin, and Karth, have shown that the expired air is free from all microörganisms, which, introduced into the lungs by the act of inspiration, are retained upon the moist surfaces of the bronchi and air-cells. Thus, the introduction of a number of animals or men into a closed room, while poisoning the air with irrespirable gases, gradually frees it from microörganisms. This fact does not invalidate the observation just made and long ago established by Pasteur and many others that the number of mocroörganisms in a room corresponds with the number of its inhabitants: for movements of the inhabitants detach or set free the numerous microörganisms deposited upon the clothing, floor, and walls. One circumstance, therefore, which would tend to render the atmosphere of a closed apartment aseptic would be the introduction into it of a number of human beings, an experiment which we see made every day, but which has its results ruined by the subsequent multiplication of microörganisms in and from infected individuals.

No attempt has been made hitherto in this study of the infection of the air to separate the microörganisms of disease from those essential to life, the pathogenic from what we might term the genetic germs. In a general way, it is known to be true that an atmosphere infected with a great number of microörganisms is, or is liable to be, contaminated by the largest number of the microörganisms of disease. But direct disclosure of pathogenic microörganisms, even in the air or on the walls of closed compartments, is very difficult, and has been accomplished positively only in the case of erysipelas and septicæmia. Kümmel claims to have found all kinds of microörganisms on the walls of his operating-room. Emmerich found on the walls of the pathological institute of Munich the microörganisms of erysipelas, a discovery which

was verified by cultivation and inoculation. Eiselsberg found deposited on slides placed on and under the beds of Billroth's wards the staphylococcus aureus, and later, in the same way, Fehleisen's streptococcus. Uffelmann found Friedländer's pneumonia bacillus in the air of a cellar under the hygienic institute at Rostock, and Cornet without doubt inoculated tuberculosis with sponge-scrapings from headboards of beds and walls of rooms occupied by phthisical patients.

Concerning the presence of microörganisms in general the wall studies of Esmarch, published in the *Zeitschrift für Hygiene*, vol. ii., constitute models for future investigation. Esmarch rubbed down definite spaces of wall paper with thoroughly sterilized sponge and cultivated the germs thus removed in various soils, finding thus, on an average, from various rooms 51 germs in 25 square centimetres, from which he computed 20,400 to the square metre; and to a whole room 979,200, a number he thinks too small rather than too large. Any pathogenic germs in the air of the room must, of course, constitute a certain percentage of this number, and these germs, with the rest adhering but loosely to the walls, are liable to be detached at any time. Hence the danger of tearing off the paper from walls, whereby all kinds of microörganisms are set free in the rooms in efforts at disinfection, which should be effected by means which incorporates everything in itself, as by rubbing-down with bread, to be subsequently burned. Such a method is now enforced by legal enactment in the city of Berlin. As was to have been expected, papers showing a rough surface, as of silk or felt, offered lodgement to the greatest number of microörganisms. Painted walls with smooth surfaces contained less than smooth, unpainted papers. Closets but rarely opened always contain much fewer microörganisms, evidently because of less infection of the air and speedier gravitation. In all cases the number was greater nearer the floor.

Regarding specific microörganisms, model studies were made with tuberculosis by Cornet. These observations of Cornet, which extended over a period of two years and were first published in abstract (*auto referat*) in the *Wiener medizinische Wochenschrift*, June 2, 1888, constitute the most remarkable contribution to the etiology of tuberculosis since the disclosure of the tubercle bacillus by Koch in 1882. The fact that all experiments hitherto had failed to discover tubercle bacilli in the air or in the walls of houses led the author to adopt the inoculation test with sponge-scrapings from walls and beds of rooms occupied by phthisical patients. The sponges were, of course, previously thoroughly disinfected, and the animals inoculated, freshly

bought and free from infection, were, if not dead from other disease, killed after the lapse of forty days—a period in which the disease remains confined to the peritoneum, into which the injections were made.

The walls and headboards of beds, posterior surface uncontaminated by sputum or hands, of 21 rooms in 7 hospitals of Berlin occupied by phthisical patients were scraped in this way and 94 animals were inoculated with the scrapings. 15—*i. e.*, two-thirds—of the rooms furnished tuberculous matter. Of the 94 animals, 53 died of other diseases; of the remaining 42, killed after forty days, 20 were tuberculous, 22 sound. The frequency of tuberculosis among the insane led the author to examine the walls of 3 asylums, all of which furnished a virulent tuberculous virus. Dust removed in 11 cases from different places in the near vicinity of tuberculous patients was introduced into 33 animals, of which 16 died of intercurrent disease, 3 were found to be tuberculous, the remaining 14 healthy. 61 dust tests from the walls of houses of 53 private patients affected with tuberculosis, were introduced into 168 animals, of which 90 died soon after the injection, 34 were found tuberculous, the rest sound.

Control experiments from houses not inhabited by tuberculous patients, from surgical wards, operating rooms, crowded streets in Berlin, various public buildings, gave negative results.

Of 311 animals, in all, inoculated with dust from rooms inhabited by phthisical patients, 167 died soon after infection; 59—*i. e.*, one fifth of the whole number—were found tuberculous, and 85 were healthy. A room in a hotel occupied for six weeks by a phthisical actress, and a workshop occupied by a tailor who had directly communicated the disease to a fellow-worker, were found infectious. *But in no case was the dust of the walls infectious where sputum cups and cuspidores were used exclusively to receive the expectorated matter*, notwithstanding the fact that such sputum often abounded in bacilli.

These observations, which singularly confirm the first statements of Koch, that the diease is chiefly spread by dried sputum, furnish convincing proof of the possibility of preventing tuberculosis pulmonum altogether, a possibility which should be seized upon with all the more avidity, in that the same author shows the futility of all specific treatment with the most varied agents.

From this brief and superficial survey of the constitution of the air the inference is fair that the contagious diseases are contracted not outside but inside the walls of houses, from microörganisms liberated from previous cases of disease, and circulating in the air or lying

latent upon the walls and floors of houses, until detached by currents of air and inhaled into the bodies of susceptible subjects.

The proper disinfection of a room would mean, therefore, the removal of all carpets, rugs, curtains, upholstery, to be shaken in the open air and ventilated by exposure in it for several days; the subjec tion to steam heat of all bedding and clothing in any kind of contact with the sick; the rubbing-down of walls with bread or bread-stuffs, which compse the bulk of the patent compounds for this purpose, two or three times successively, and the scrubbing of floors with solutions of corrosive sublimate, one part to one thousand parts of water; withal, the ventilation of the room day and night for several days, at least, to remove as much as possible germs still floating in the air; *in short, to bring as far as is possible the inside into the condition of the outside air by dilution, which is, after all, in the absence of fire the essence of disinfection.*

But inasmuch as the extinction of a spark is easier than the suppression of a conflagration, the true method of making the air of a locality aseptic is to stamp out the spark. There is, as yet, nowhere in our country, at least, from lack of authority, any systematic attempt at the destruction of the germs of disease as they are produced. The discharges of typhoid fever, cholera, dysentery, yellow fever, are turned into sewers or scattered over soils with the same indifference as in the days when bacteriology was unknown, and with total disregard of its discoveries. Smallpox, which needs it least, meets with more attention from health authorities than scarlet fever, which is more fatal than cholera. Let it be mentioned, in passing, that but a single soldier in the whole army of Prussia has died of smallpox in the last thirteen years. Tuberculosis, which is now believed to be always acquired, and which destroys two-sevenths of mankind, meets with no check at all. The fear of "taking cold," by shutting out all ventilation, is largely responsible for the concentration of pathogenic microörganisms in sick-rooms and the consequent dissemination of contagious disease.

Conditions which tend to render the atmosphere of a locality aseptic. Let us consider the subject from the standpoint of a place selected for the habitation of man and erect a house which is to remain, as far as possible, aseptic. It will stand facing the sun on a dry soil in a wide, clean, amply sewered, substantially paved street, over a deep, thoroughly ventilated and lighted cellar. The floor of the cellar will be cemented, the walls and ceiling plastered and thickly whitewashed with lime every year, that the house may not act as a chimney to draw

up into its chambers microörganisms from the earth. Doors and windows, some of which extend from floor to ceiling, will be as abundant as circumstances permit, and will be adjusted to secure, as much as may be, through currents of air. The outside walls, if of wood or brick, will be kept thickly painted, not to shut out penetrating air, but for the sake of dryness. All inside walls will be plastered smooth, painted, and, however unanæsthetic, varnished. Mantels will be of marble, slate, iron, or, if of wood, plain, and whether natural, painted or stained, varnished. Interior woodwork, including floors, will all show plain surfaces and be likewise treated. Movable rugs, which can be shaken daily, in the open air, not at doors or out of windows, where dust is blown back into rooms, will cover the floors. White linen shades, which will soon show the necessity of washing, will protect the windows. All furniture will be plain, with cane or smooth leather seats, perhaps, without cloth upholstery. Mattresses will be covered with oiled silk; blankets, sheets, and spreads, no coverlets or quilts, will constitute the bedding. Of plumbing, there shall be as little as necessary, and all there is shall be exposed, as is the practice now. The inhabited rooms shall be heated only with open fires, the cellar and halls by radiated heat, or, better, by a hot-air furnace, which shall take its fresh air from above the top of the house and not from the cellar itself or the surface of the earth, where microörganisms most abound. There will be "house-cleaning" twice a year. Put into this house industrious, intelligent, and informed men and women —absolutely essential conditions—and as much will be done as at present may be done to prevent the dissemination from it of contagious disease when an inmate brings it home from a septic house, hospital, sleeping-car, school-room, theatre, church, etc. A city of this kind, with a city government by such people, conditions which at present exist only in Utopia, would least of all permit to be introduced into it cases of infections like cholera and yellow fever, which must be imported from a distance on each invasion.

CLIMATE AND BRIGHT'S DISEASE.

By J. C. WILSON, M.D.,
OF PHILADELPHIA.

The relation of climate to Bright's disease is twofold, causative and therapeutic.

All authorities are of accord as to the part played by cold and damp, and especially by sudden cold and damp, in the production of acute nephritis. The causal influence of vicissitudes of weather, and therefore of cold, damp, and changeable climates on the production of the subacute and chronic forms of nephritis, is less obivous. Bright's disease is peculiarly an affection of temperate climates, but when we take into consideration the importance properly assigned to modes of life, occupation, diet, alcohol, nervous influences, heredity, gout, and lead in its causation, we cannot but be impressed with the long-recognized fact that in whichever direction we leave the temperate zone we find a decided and rapid diminution in the frequency of this disease.

Hirsch calls attention to the infrequency of albuminuria in subtropical and in extreme northern countries. Dickinson, who has carefully investigated the subject, fully confirms this view from analysis of the statistics of the British Army Medical Reports for eight years from 1865 to 1872 inclusive. These statistics are of peculiar value, as they represent the frequency of renal affections in bodies of soldiery in every climate and at every season during the same period of time. The observations are drawn from considerable numbers of individuals of the same race, age, occupation, and habits, living under nearly similar conditions, under the observation of trained observers and with a uniform system of recording facts. They are perhaps vitiated to a certain extent by the effort which has been made to secure accuracy by eliminating from the conclusions the influence of syphilis. Dickinson found that in British America, with its low average and great variability of temperature, renal disorders are nearly as frequent as in the United Kingdom. In Newfoundland, with its exceptionally humid

climate, these disorders, so far as regards the limited number of troops there stationed, appear to be even more common than in the British Isles. With the higher temperature of New Zealand, renal disease becomes less frequent, and is least so on the subtropical shores and islands of the Mediterranean and in the solitary outposts of Mauritius and Bermuda, where a tropical or nearly tropical climate is tempered by a vast circumference of ocean. It is to be noted also that the Cape of Good Hope and St. Helena were comparatively free from renal affections. This accomplished observer also informs us that as the result of an analysis of the published registers of the causes of death, the comparatively cold cities of Great Britain and Australia show a remarkable liability to renal diseases. Paris, though not differing very much in temperature from the more fortunately situated of these cities, has a smaller proportion. Genoa, with its subtropical climate, has an almost complete exemption. He found that, in the year 1863, in England one death in 106 was due to this cause; in Scotland, one in 109; in Wales, one in 131. Of the several divisions of Scotland, in the mainland rural districts one death in 103, in the towns one death in 112, and in the insular rural districts one death in 188.

The Shetland Islands, with an almost arctic climate, enjoy an immunity from the disease not approached by any other part of the kingdom. It is further noted that within the limits of each kingdom, especially in Scotland, where the climatic differences are much more marked, there is a striking general correspondence between the amount of renal disease and the changeability of the climate. He found that in the Southern hemisphere exposure to a similar climate is attended with the same results. In Melbourne, with a mean temperature of 57°, renal affections are scarcely less common than in London. This appears from the results of general registration, while the mortality from kidney disease in the Melbourne City Hospital, one in thirteen, is much what occurs in similar institutions in England.

On passing the mean of 60° F., the frequency of renal diseases displays extraordinary diminution. "Renal diseases, putting aside that of lardaceous origin, are the compatriot of wheat and barley rather than of the vine and the olive. They abound wherever the climate, however cold during the winter, is warm enough in the summer, as in Canada, to bring wheat to perfection, and become scarce where oranges and lemons grow, and where deciduous trees, as generally characteristic of the scenery, are replaced by palms and other tropical endogens. In other words, they prevail wherever the heat for a considerable portion of the year is what would ordinarily be called

temperate, as in Great Britain, or so for a large period of the year, as in British North America, where comparatively mild weather divides the year with continuous frost.

Dr Dickinson's researches further show that with tropical heat renal disease increases. They also confirm the opinion generally entertained, that the prevalence of these affections is promoted by frequent and abrupt changes. On the western coast of Scotland, where there is scarcely heat enough in summer to ripen wheat, but where the winters are warm from the influence of the Gulf Stream, so that a very uniform temperature prevails throughout the year, "renal disease is not half so frequent as on the eastern side of the kingdom, where the weather is both clearer and healthier than on the Atlantic shore, but undergoes much larger and more frequent variations."

The records on which these conclusion are based do not permit of a distinction between the acute inflammatory affections of the kidney and the more insidious and chronic forms of Bright's disease.

I am not aware that similar investigations on a large scale have been made in this country. Without doubt an analysis of the records of the great life insurance companies as regards the proportion of applicants rejected on account of Bright's disease and of deaths due to this cause, would shed much light not only upon the influence of climate, city, and rural life, occupation, and other important factors in the causation of this disease, but would also yield important facts in regard to the duration of the disease under varying circumstances.

Experience has abundantly proved that climate exerts an influence upon the course and duration of chronic forms of Bright's disease scarcely less important than in its causation. The concurrent testimony of all observers who have given their attention to the subject of the climatic treatment of Bright's disease, points to the salutary influence of prolonged residence in favorable subtropical regions, especially in cases where the disease has not yet made much progress. The late Professor Flint laid great stress upon the importance of a change of climate in chronic Bright's disease. You, yourself, Mr. President, have in your lectures and published writings emphasized it. Tyson and Purdy dwell upon it with a positiveness not found in the earlier writers. Dr. Dickinson goes so far as to say that

"The advantage to be expected from a change of sky is at least as great in renal as in pulmonary disease. Cure is a word to be used with caution, but I have seen little less, the albumin reduced to a trace and perhaps that inconstant, and the general health brought up almost to its original level."

Dr. George Johnson writes:

"Among other remedial agencies, when acute renal disease is prolonged and threatens to become chronic, change of air and scene is often highly beneficial. Residence during the winter season in a warm, dry, equable climate, such as may be found at Cannes, Nice, Mentone, and Algiers, has in many instances, been attended with highly beneficial results. The bright warm sun and dry invigorating air, favor the action of the skin and of the bronchial mucous membrane; the patient is able to be much in the open air and thus the respiratory, the digestive, and the secretory functions are all assisted and promoted. I have seen some most remarkable recoveries effected under the influence of a long voyage after other means had failed to effect a cure."

On the other hand, the climatic treatment of Bright's disease seems to have been strangely overlooked by teachers of influence and authority. No reference is made to it in Bartel's article in Ziemssen's *Encyclopædia*, nor in that of Delafield in Pepper's *System*, nor in that of Grainger Stewart in Quain's *Dictionary*, recent works of reference on the shelves of practitioners; while in the text-books in the hands of medical students, references to the influence of climate in the causation and treatment of Bright's disease are rare and brief.

The most desirable climates are those which combine the attributes of evenness, dryness, and warmth, with a mean range of temperature between 60° and 65°. On the North American continent, a number of stations in the southern interior meet these indications. Among these are Thomasville and Tallahasse. The stations in the interior and on the Gulf coast of Florida are well suited to this class of patients. Southern California has several suitable stations. Nassau and Bermuda are to be recommended. The stations on the Mediterranean coast offer special advantages as winter resorts for patients suffering from chronic Bright's disease, while Algiers, Cairo, and the Cape of Good Hope are also favorably spoken of.

This paper would have occupied your considerate attention to little purpose, however, had it contained nothing beyond the familiar facts already mentioned. In availing ourselves of the advantages of the climate treatment of Bright's disease, we must not overlook the dangers of abrupt changes of climate and of the vicissitudes of travel in patients in whom the disease has already made some progress. It is with the view of eliciting discussion and obtaining the results of the experience of my colleagues in this Association that I submit certain conclusions drawn from my own experience; and with the view of saving

time, I venture to embody them in the form of the following propositions:

1. The best results of climate treatment in Bright's disease, as in phthisis, are obtained in the early stages of the affection, and by continuous residence. After the general health has become seriously impaired, an amelioration of the symptoms is all that can be hoped for. Alternations of climate, especially those necessitating long and fatiguing journeys by rail are attended with the danger of uræmia.

2. High altitude climates, even when presenting the conditions otherwise favorable, are unsuitable for this class of patients. Uræmic attacks and cardiac failure not infrequently shortly follow change of residence from low to high altitudes—differences of three thousand feet or more.

3. The conditions of North Atlantic steamship travel are often highly unfavorable to those suffering from advanced Bright's disease; especially is severe and prolonged sea-sickness liable, in these cases, to terminate in fatal uræmia.

ROAN MOUNTAIN, WESTERN NORTH CAROLINA.

By CHARLES J. KENWORTHY, M.D.,
OF JACKSONVILLE, FLORIDA.

During the summers of 1886 and 1887 I visited numerous points of professional interest in western North Carolina. From personal observation I was convinced that many of them had been overlooked as sanitary resorts by interested parties. This section is remarkable for its healthfulness, away from centres of population. Malaria does not exist, insect pests are absent, the climate at certain points is all the invalid and visitor can desire, the section is accessible, and the residents are honest, moral, temperate, kind, and attentive to strangers.

One great objection to many portions of the State is the existence of a cold, damp, red clay soil, which becomes converted into a tenacious mud by rain, and into an irritating dust containing micaceous particles by the wheels of passing vehicles during dry weather.

At nearly all the so-called health resorts sanitation is defective, as it is customary to deposit slops and refuse on the retentive soil, where they decompose and produce typhoid fever and dysentery. During the summer of 1886 I suffered as much from heat at three noted health resorts in North Carolina, ranging from 2250 to 2700 feet above the ocean-level, as I ever did in eastern Florida.

From personal observation I am induced to write in laudatory terms of two health resorts in western North Carolina—Blowing Rock, Watauga County, and Roan Mountain, Mitchell County. The elevation of the former is 4025 feet above ocean-level; air and water are pure, days and nights cool; the roads are excellent, and the country comparatively level, the soil is a yellowish, sandy loam; accommodations for visitors good and ample. This desirable locality is not blessed with a medical scribbler, and in consequence its climatic advantages are unknown. But the time is not far distant when it will become a popular resort for invalids and persons seeking a delightful summer climate. From the north it is accessible by the Western North Caro-

lina Railroad to Hickory, from thence to Lenoir by a narrow-gauge railroad, and from Lenoir to Blowing Rock, a distance of twenty-two miles, by carriage over an excellent turnpike.

Roan Mountain is the highest point in the Unaka range of mountains—altitude 6394 feet above sea-level. The hotel is located on the top of the mountain, and is the highest human habitation east of the Mississippi; 200 feet higher than the White Mountains, N. H.; 4114 feet above Asheville, N. C.; 1200 feet above Denver, Col.; 4400 feet above the Catskill Hotel, N. Y. The prospect from the top of the mountain is grand, for the eye ranges over portions of seven States.

The upper 1500 feet of the mountain is densely covered by a luxuriant growth of firs, giving out a continuous supply of ozone and balsamic odors. The top of the mountain is devoid of timber, and is clothed with a luxuriant growth of grass. The air is aseptic and dust is absent. The rock is granitic, overlaid by a deposit of small stones, and upon these a layer of light brown porous soil, through which the rain percolates as it falls. Owing to the absence of timber on the mountain top, evenness of surface, and dryness of the soil, excellent opportunities exist for driving, and pedestrian and horseback exercise. The water is cool and remarkable for its purity. I tested three springs near the hotel, and found the temperature to be 43°, 45°, and 48° F. Although apparently pure, the action of the water on the kidneys was remarked by visitors.

The thermometric range of Roan Mountain is remarkable, as will be seen by the accompanying observations carefully taken by myself, by reliable instruments, under conditions similar to those of the signal service.

The surprising thermometric range of Roan Mountain can only be accounted for as a result of its surroundings. The mountain is about nine miles in length, and is surrounded by a valley elevated from 2300 to 2700 feet above ocean-level. After sunset the warm air rises from the valley, hence the slight variation of temperature between day and night.

The rainfall on Roan is comparatively light. The moist atmosphere from the Atlantic and Gulf, blowing toward the west and northwest, comes in contact with the Blue Ridge and Black Mountains, and the moisture is precipitated in the form of rain. At times the top of the mountain is enveloped in clouds, but this condition did not seem to exert any injurious influence upon invalids.

The mountain is situated in the "calm belt," and it is to a remarkable extent exempt from severe winds. Easterly and southerly winds

Temperature.

July.					August.					September.				
Date.	7 A. M.	2 P. M.	9 P. M.	Mean.	Date.	7 A M	2 P. M.	9 P. M.	Mean.	Date.	7 A. M.	2 P. M.	9 P. M.	Mean.
1					1	61	66	60	62.3	1	46	58	58	54
2					2	61	65	64	63.3	2	48	58	52	52.7
3					3	65	71	65	67	3	53	58	53	54.7
4					4	68	67	64	66.3	4	56	59	55	56 7
5	63	70	62	65	5	64	66	61	63.7	5	54	63	56	57.7
6	61	69	61	68.7	6	61	67	62	63.3	6	56	68	55	59.3
7	59	68	64	63.7	7	61	65	61	62.3	7	54	61	56	57
8	64	71	65	66.7	8	60	67	60	62 3	8	52	65	57	58
9	63	69	62	64.7	9	60	65	59	61.3	9	50	65	57	57 3
10	60	67	61	62.7	10	60	66	62	62.7	10	56	71	62	63.3
11	61	66	60	62.3	11	61	71	61	64.3	11	60	71	60	63.7
12	63	70	62	65	12	61	69	64	64.7					
13	65	67	64	65.3	13	63	69	65	65.3					
14	65	73	62	66.7	14	65	78	64	65.7					
15	65	72	66	67 7	15	63	67	63	64.3					
16	65	74	65	68	16	62	66	60	62.7					
17	64	73	66	67.7	17	60	62	58	60					
18	66	74	68	69.3	18	61	61	60	60.7					
19	68	76	70	71.3	19	60	63	60	61					
20	64	72	66	67.3	20	59	64	61	61.3					
21	63	71	65	69.7	21	60	64	58	60.7					
22	58	69	68	65	22	59	67	59	61.7					
23	58	68	58	61.3	23	59	66	59	61.3					
24	59	62	57	59.3	24	60	56	51	55.7					
25	58	67	58	61	25	57	60	56	57					
26	58	65	60	61	26	54	53	56	54.3					
27	59	68	60	62.7	27	57	55	49	53.7					
28	61	69	60	63.2	28	50	56	48	51.3					
29	60	68	63	63.3	29	48	53	46	49					
30	62	61	60	62	30	44	54	45	47.7					
31	61	56	60	62	31	44	53	47	48					

MEAN RELATIVE HUMIDITY.—*Results of Three Daily Observations of Wet and Dry Bulbs.*

JULY.				AUGUST.				SEPTEMBER.			
Date.	Mean Relative humidity.			Date.	Mean relative humidity.			Date.	Mean relative humidity.		
	7 A. M.	2 P. M.	9 P. M.		7 A. M.	2 P. M.	9 P. M.		7 A. M.	2 P. M.	9 P. M.
				1	89	85	89	1	79	72	47
				2	89	85	85	2	73	67	63
				3	80	72	85	3	75	72	69
				4	85	85	90	4	82	72	76
				5	79	71	89	5	70	84	77
				6	89	53	84	6	65	71	76
				7	84	75	84	7	82	68	82
				8	73	76	84	8	75	75	50
				9	73	61	78	9	74	56	71
				10	78	75	74	10	65	52	54
				11	73	60	78	11	48	64	68
				12	73	67	79				
				13	87	59	79				
				14	85	67	74				
				15	79	71	84				
				16	79	75	58				
				17	84	84	78				
				18	89	89	78				
				19	84	79	84				
				20	89	70	73				
				21	84	79	94				
22	78	72	54	22	83	76	72				
23	89	71	78	23	62	71	78				
24	78	89	77	24	84	88	87				
25	83	66	83	25	61	68	77				
26	89	85	89	26	76	81	88				
27	89	63	84	27	83	88	86				
28	78	67	89	28	87	65	79				
29	94	63	79	29	79	75	85				
30	84	89	38	30	78	62	50				
31	84	75	84	31	70	58	72				

OZONE—*Amount of Ozone in the Air of Roan Mountain, as indicated by daily observations, by exposing test paper prepared by Schonbein's formula from* 7 A. M. *to* 7 P. M., *and from* 7 P. M. *to* 7 A. M. *Recorded according to a scale of ten degrees of coloration of test paper.*

JULY.			AUGUST.			SEPTEMBER.		
Date.	Day.	Night.	Date.	Day.	Night.	Date.	Day.	Night.
1			1	4	3	1	4	3
2			2	1	2	2	4	4
3			3	2	3	3	4	3
4			4	2	2	4	2	3
5			5	4	3	5	5	3
6			6	5	6	6	3	4
7			7	3	7	7	4	3
8			8	7	7	8	4	5
9			9	3	5	9	4	6
10			10	2	4	10	3	5
11			11	3	3	11	4	3
12			12	6	3			
13			13	3	5			
14			14	3	6			
15			15	1	3			
16			16	4	8			
17			17	6	5			
18			18	5	3			
19			19	2	4			
20			20	3	3			
21			21	2	2			
22			22	3	3			
23	3	6	23	4	2			
24	5	3	24	5	3			
25	3	2	25	4	5			
26	4	7	26	5	4			
27	1	3	27	3	5			
28	1	3	28	2	4			
29	1	4	29	3	3			
30	3	3	30	4	3			
31	3	1	31	5	3			

are, of course, warm, and westerly and northwesterly winds pass over the valley of East Tennessee, and are robbed of their chilling effects.

It has been claimed that the air of Roan Mountain is an absolute cure for that distressing complaint, hay-fever. I found a number of the victims of this affection at the hotel, and ascertained that the majority escaped, and that a very few had slight attacks of the disease, more especially if visitors decorated the parlors with wild flowers. In many cases patients were relieved of their symptoms soon after arriving at the mountain-top.

The air seemed to act as a tonic, and almost every visitor rapidly gained in avoirdupois. In but one instance did I find a person to suffer from *Siroche.*

That eminent authority, Dr. Sparkes, says: "The therapeutic elements of most importance in any climate are: 1. Pure air, free from dust and organic particles. 2. Abundance of sunshine, without excessive heat, so that much time can be spent in the open air. 3. A temperature without extremes, so that the body is not exposed to the risk of great variations of heat and cold—equality. 4. Absence of violent, very cold, or very hot winds, or at any rate of long duration." From personal observation I have no hesitancy in stating that these conditions exist on Roan Mountain.

From my observations and inquiries I have reason to believe that the cases of pulmonary disease adapted to this elevated locality during the summer months are phthisical cases of the early catarrhal and quiescent pneumonic group, especially in persons with a moderate degree of anæmia; cases of threatened consumption from hereditary tendency, defective chest formation and capacity, incomplete recovery from acute and subacute inflammatory affections. Roan Mountain seems specially adapted to the treatment of conditions of general debility arising from constitutional tendencies, from overwork, or from attacks of exhausting diseases; in cases of slow recovery from the effects of typhoid, intermittent, or remittent fevers, in malarial cachexia, in anæmia, in nervous affections, insomnia, and neurasthenia.

Having wandered over a large portion of western North Carolina, and studied its climatic factors, I am of the opinion that the day is not far distant when the advantages of localities of over 4000 feet above the ocean-level will become known; and physicians of the northern States will send their patients to accessible points where the water is pure, the air aseptic and free from dust; a low range of tem-

perature with equality, where a patient can spend most of his time in the open air without being oppressed by heat, where violent winds do not exist; to a place which may be reached by an easy journey, and in case of need where the patient can communicate quickly with his physician and friends at home.

SUGGESTIONS REGARDING THE MANAGEMENT OF PHTHISICAL PATIENTS AT HEALTH RESORTS.

By ISAAC HULL PLATT, M.D.,
OF LAKEWOOD, N. J.

This paper is intended merely as a note calling attention to some mistakes which I have observed in the conduct of patients in search of health, presumably due to lack of proper instruction from their home physicians, and also to some measures of treatment which I have found useful in the cases of such patients. This statement will, I hope, serve as an apology for the lack of scientific method and completeness in what is to follow.

The factors in the etiology of pulmonary phthisis are so many and so complicated that it is usually impossible to determine the precise chain of causes which result in the disease. To remove a patient from the environment in which he has lived, and in which he has contracted the disease, or developed a predisposition to it, and place him under conditions as far removed as possible from those under which he has been living, might very likely result in benefit by removing the unknown cause of the disease among the other conditions of the patient's former life. But from the fact that good may be done by this arbitrary method, it must not be concluded that much more advantage might not arise from a judicious and rational use of the elements of climate.

The proper application of climatic treatment depends upon two things: First, the selection of the proper climate; and, second, the direction of the invalid's life while away from home so as to secure the greatest amount of good from the changed conditions. Dr. Knight has recently given us some good advice upon the former subject, and it is of the latter which I wish to speak.

For the past two years I have been so situated as to observe the doings of many invalids, sojourning away from home for their health. I find that, as a rule, they come without any special directions from

their physicians, believing that the change of air will be a cure for their troubles no matter how they conduct themselves. Or they come with certain directions from their physicians, which they follow implicitly, very likely under conditions which have altogether changed since the directions were given, and where they may do more harm than good. As an example of the latter class, I may cite the case of a lady who was told by her physician to go to Lakewood and take cod-liver oil, which she did. After about a month she consulted me. I found her in the third stage of phthisis, much emaciated, cough very severe, temperature 103° to 104° in the afternoon, and her stomach in such bad condition that she vomited every day. In spite of all which, she continued conscientiously to take the cod-liver oil, and vomit it; and, believing that exercise and pines were good for her, walked about two miles every day, to and from the pine woods. A week of rest from the cod-liver oil and the walking, with a little tonic and antipyretic treatment restored her stomach to comparatively good condition, brought her temperature down to 100° as the daily maximum, and rendered her tolerably comfortable. She was then sent home, as her disease was so far advanced that that seemed to be the best place for her.

The most frequent errors which I have observed on the part of invalids have been the frequenting of hotel parlors, very likely close and over-heated, during the evening; remaining within doors, probably in their sleeping-rooms, during the day-time; over-exertion; and the use of drugs which are unsuited to their condition, although perhaps proper enough when first prescribed.

If I understand the objects in a change of climate correctly, they may be classified somewhat as follows: First. The influence of the rarefied air of high altitudes, which has an undoubted beneficial effect upon properly selected cases, probably by increasing respiratory activity. Second. The substitution of a purer and consequently more nearly aseptic atmosphere for that in which the patient has lived. Third. In case the patient is a resident of a city, the opportunity of spending a greater portion of the day in the open air. Fourth. The escape from the conditions under which the disease has probably developed. Fifth. The mental and moral stimulant of change *per se.*

It will be seen that with exception of the first and last, they are negative—that is, they are attempts to escape from unfavorable conditions to those less so. High altitudes seem suited to those cases retaining a certain amount of vigor in which the heart is sound, and in which the disease has not progressed too far, and where the bronchitis or nervous irritability are not too great to endure the highly stimu-

lating atmosphere. Cases suited to this form of climatic treatment require little or no medicine, should remain as much as possible in the open air, should practice mountain climbing, one of the most potent adjuncts to the expansive action of the rarefied air, of course stopping short of over-fatigue.

Under the second head, the obtaining of pure air, it would seem as though it ought to be unnecessary to protest against the supposition that pure air can be found in an over-crowded ball-room, or in a close sleeping apartment, and yet experience proves otherwise. Closely connected with the subject of fresh air is that of exercise. In the city it is almost impossible to obtain such comparatively fresh air as exists there without what, for an invalid, is over-exertion. He may take a drive for an hour or two, and, if strong enough, a walk. But as people do not care to sit on the front steps, or in the back yards of their residences, the greater part of the time will be spent indoors. The mere fact that in the country one can live an out-of-door life, is, in my opinion, one of the greatest sources of benefit in climatic change. In the case of a person whose strength is not at all, or but little, impaired by disease, it is well to combine exercise with the out-door life. Mountain climbing, horseback riding, tramping, tennis playing, here have their place, but, as a rule, the matter of exercise is overdone, and I have frequently observed debilitated invalids squandering their little store of strength by over-exertion. In the summer or in a semi-tropical climate, where invalids can sit or lie in hammocks or on cots out of doors all day, the problem solves itself, but in colder climates in winter, it requires some management. If I were designing a sanitarium or hotel at a winter resort, I should have it constructed upon the following plan: The house should stand upon a southern slope, and of course face the south. Across the front should be a veranda, which instead of being enclosed to form a sun-gallery, as is the usual custom, should be open to the south, but protected at the east and west ends by glass screens. If the veranda were of considerable length, I should in addition place similar screens across it at intervals of twenty or thirty feet, to prevent any sweep of the wind along its length. Except in special cases, where the larynx or bronchial tubes are extremely sensitive, an invalid could sit upon a veranda constructed in this fashion in the coldest weather; and even without any special construction, I have seldom been unable to find sheltered nooks where invalids could sit even in midwinter, wrapped up as if for a sleigh ride, if necessary, with perfect comfort and great benefit, nor have I known any cases where harm has resulted. Those cases where the laryngitis or bron-

chitis is too severe for this treatment should go to a warmer climate, if anywhere away from home. Patients should accustom themselves to sleep with open windows, which may necessitate having their apartments warmed at night. In short, they should remain in the open air as much as possible, thus carrying out the principle of Dr. Dettwiler's Sanitarium, where such excellent results are obtained.

Under the head of the mental and moral effect of change, arises the question of sanitaria. The discussion of the comparative advantages of sending patients to sanitaria or allowing them to select their own places of residence, I have left to my friend Dr. Kretzschmar, who has made a study of the subject, and is much more competent to speak of it than I. I will, however, suggest that while it is most certainly desirable in many cases that patients should be under close watch, and their daily lives regulated in all their details, yet the close association with other invalids is very depressing in its mental and moral aspect. However situated our patient may be, all practicable should be done to make him forget his illness and enjoy himself, thus giving him the benefit of a rational mind cure.

In dealing with phthisis pulmonalis we are fighting against odds, and it is important to seize and hold every vantage-ground possible, and to bring into action every weapon which our therapeutic arsenal supplies, and the fact of our having adopted the plan of climatic treatment is no reason for dispensing with any other means of combating the disease.

With regard to the question of climatic treatment applied to phthisis, our patients may be grouped in three general classes. First, those who are merely threatened with the disease, or, having developed some slight signs, do not suffer from much constitutional disturbance, pyrexia, or loss of strength and appetite; second, those in whom the disease is more advanced, who have become to some degree emaciated and debilitated, who may be suffering from pyrexia or anorexia, in short who are actually ill, and yet not beyond the hope that climatic change, with judicious treatment, will result in alleviation or arrest of the disease; third, those cases where advanced destructive changes in the lungs, combined with evidence of rapid progress of the disease, show them to be hopeless and render it improbable that change of climate will do sufficient in the way of alleviation to recompense them for the loss of home comforts.

The first class consists of those cases of which I have spoken as most suitable for high altitudes and outdoor life. They should receive instructions to spend their time, as much as possible, in the open air and to take

exercise suitable to their strength, the best form of which, for those who are strong enough to endure it, is undoubtedly mountain-climbing, from its action in expanding the lungs. In these cases, as in all others, the place selected should be one where there is no stint of good wholesome food. Beyond attention to these points, this class of cases should not need much treatment, but they should be instructed to seek medical advice upon the first appearance of any new development.

Of the third class of cases, those with advanced disease, it is unnecessary to say anything, as they are not proper subjects for climatic treatment. The intermediate class is the one requiring the most careful and judicious management. If it is decided to send a patient of this class away from home, it is essential in the choice of a place to consider, not only the suitability of the climate to the patient's condition, but the character of his proposed surroundings with regard to comfort. He should, of course, have as good, wholesome and appetizing food as possible; his sleeping apartment should be large and airy, should receive plenty of sunlight, and should be furnished with an open fireplace. The appointments and surroundings of the house which is to be his temporary home should be as cheerful and pleasant as possible, and should be furnished with spacious sunny verandas. These seem like truisms, but they are none the less important, and none the less neglected. Good drives and a good livery are essentials for patients who are not strong enough for much tramping, and are desirable for those who are.

No place, however desirable in other respects, is suitable for these patients unless supplied with a reliable physician—one to whom the home physician feels that he can confide the care of his patient; for it seems sufficiently evident that a person suffering from a serious chronic disease should not be at a distance from good medical attendance. He should be instructed to report to the local physician upon his arrival, even if in no immediate need of treatment, in order that the latter may become acquainted with his history and general condition.

The general management of patients at health resorts, does not differ materially from the home treatment, except so far as it involves the use to their best advantage of the increased facilities. The main points to be observed, are to obtain the greatest amount of fresh air, the fullest lung expansion, and the best possible nutrition. Means to the attainment of these ends, together with the the treatment of symptoms as they arise, is the writer's idea of the proper management of phthisis. With regard to fresh air, the problem is the one already mentioned, to induce patients to remain in the open air without tiring themselves by over-exertion.

It takes some little time to make people believe that they can sit in the open air in cold weather without taking cold, but when they once try it, properly protected from wind and cold, they are usually so much pleased with the result as to require no further urging. I am in the habit of keeping my phthisical patients out of doors as many hours of the day as possible, of having them sleep with open windows, and instructing them to allow the windows of their chambers or living rooms to remain open whenever they are not occupied, to allow of thorough ventilation. This is the nearest approach to an outdoor life that I have been able to bring about, and I have been well pleased with the results, but a plan by which a continual outdoor life can be led, without so much exposure, is undoubtedly a desideratum.

Lung expansion can be best accomplished in those cases where the patients are strong enough by mountain climbing, and other forms of active exercise, but unfortunately few of our patients are capable of the exertion ; and then our best expedient is to fall back upon passive expansion by means of the pneumatic cabinet, or what I regard as equally efficacious, and prefer upon the score of simplicity and cheapness, Dr. S. Solis-Cohen's modified Waldenberg compressed air apparatus. This apparatus I have combined with a slight modification of Semple's atomizing inhaler, by means of which an exceedingly fine nebulized fluid is suspended in the compressed air and inhaled with it. In this manner I believe that a fluid can be carried farther into the air-passages than by any other method of which I know.

To accomplish the best possible nutrition of our patients is undoubtedly the most important indication of treatment, but one of the most difficult to fulfil. Of course the first thing to be attended to is to see that the table fare is good, wholesome, nutritious and appetizing. If insufficient nutrition is accomplished by this means, it must be supplemented by milk, or milk and beef powder, or one of the most reliable preparations of beef peptonoids taken between meals. If this cannot be persisted in owing to gastric catarrh or indigestion, resort should be had to gavage, practised twice or thrice daily; and when there is much gastric catarrh, lavage once a day. Lavage and gavage undoubtedly form our most powerful means of increasing nutrition, and a case seldom occurs where they are not well borne, and the results well marked. In any case of forced nutrition, however, it is necessary to give the digestive organs a few days' rest occasionally when they show signs of fatigue. In regard to gavage, I find it much more easily borne and equally efficacious when performed with the small short tube with a forcing bottle as described in Dujardin-Beaumetz's *New Remedies* than when the stomach tube is used.

TEMPERATURE AND ATMOSPHERIC HUMIDITY AND THEIR RELATIONS TO HEALTH AND DISEASE.

By J. M. ANDERS, M.D.,
OF PHILADELPHIA.

Among the vital climatic conditions most conducive to health, next to purity in the air we breathe, are temperature and the degree of saturation. These are also chief meteorological elements in determining climate. But, preliminary to entering upon a discussion of this theme, a few general remarks may be permissible. A brief study of some of the causes operating to explain conditions of temperature and degrees of humidity, seems peculiarly desirable. Among the most potent of these causative forces, movements of the body of the atmosphere stand foremost. These movements are occasioned by variations in the degree of atmospheric pressure at different places, the flow being from a point of higher to one of lower pressure; and thus is defined the well-known phenomenon, wind.

Now the prevailing winds, in traversing a region, and transporting the moisture in the atmosphere, are perhaps, the main agencies in determining and regulating the temperature and humidity of a given region. They exhibit marked seasonal as well as geographical variations. Over the sea, for example, there are cold currents which convey the low temperature of the polar regions toward the tropics, on the one hand; and warm currents travelling from the tropical regions to the high altitudes of the more northern countries, on the other. In enumerating other conditions than wind, which greatly modify the temperature and relative humidity, such varied considerations as the physical conformation of the earth's surface, the degree of latitude, proximity to the coast, and the regions from which the prevailing winds come are, however, also worthy of chief mention. The meteorological components under discussion have long been studiously investigated in relation to their effects upon the course of storms. In 1858, Leverrier ingeniously devised the best method of conducting observations with a view of fore-

casting the weather; and already in the same year, the daily report, the *Bulletin International*, began to be issued. This phase of the present inquiry, though of the highest interest, does not concern us, except so far as these meteorological data relate to the application of temperature and the degree of saturation to the laws of sanitation.

In this connection, the fact that all atmospheric phenomena are fundamentally due to the action of the solar rays, deserves to be noted. Meteorological science recognizes two kinds of radiation, named from their respective sources, solar and terrestial. This subdivision, it might be well to note, is based upon the natural law that, when two bodies of unequal temperature are placed near together, there is a mutual interchange of heat, the cooler body receiving more heat than the warmer. In the case of the earth, as it revolves on its axis in space, that part which is exposed to the sun receives more heat than it radiates, hence, it also happens that those regions receiving the perpendicular rays are warmest; while those around the annulus, where the inclination of the earth's surface is greatest, have for the time the lowest temperature. In this wise do we account for the difference between the temperature of the torrid, temperate, and frigid zones, as well as for the seasonal difference in the markings of the thermometer of any given locality.

Now, the atmosphere is heated by means of radiation from the earth and sun, the lower strata of air absorbing the greatest amount of heat; hence it follows that as we leave the earth and ascend, the atmosphere grows sensibly cooler, for as the air becomes rarefied, its power to absorb and radiate heat, two processes that are entirely reciprocal, becomes decreased.[1] With regard to the daily march of the temperature it is to be noted in the first place, that the time of the occurrence of the maximum, mean, and minimum daily temperature is very various for different regions; thus, they occur at earlier hours of the day over the sea than over the land; and on the other side later in the day in the forest than over the exposed soil. The earth's covering has a decided influence in determining the phase of temperature before mentioned. Owing to its intercepting powers the vegetable covering prevents the solar rays from reaching the earth and warming it, as they do in the case of the exposed soil. The temperature of the open soil is higher than the temperature of the vegetable canopy upon which the sun's rays fall. It is, therefore, a natural corollary that the temperature of the air of the forest is lower than the temperature of the outer air;

[1] The question of mean and annual rainfall does here not concern us; besides, it has been fully discussed by Professor Loomis and Dr. A. Weoikoff (Amer. Journ. of Science).

and the same difference is observed between the exposed and forest soil. As the result of trustworthy observations made in the forest of Vienna, extending over a period of eleven years, Dr. Hann[1] found the temperature of the forest air to be lower than outer air; and these differences were observed to be greatest both early and late in the day. To explain these variations of temperature betwixt the woodland and open air, we have the following facts: The forest atmosphere contains a higher degree of humidity than outer air;[2] and it has been shown by Dr. Frankland, that any increase in the quantity of aqueous vapor, reduces the temperature considerably; the solar rays as they fall upon the surface of the leaves, are neutralized in part by transpiration; it has also been pretty clearly established that the cooling effects of nocturnal radiation from the forest penetrate lower down among the foliage, than do the warming influences of solar radiation in the day.

Perhaps the most prodigious influence in regulating the temperature is found in the marine currents. Both the North Atlantic and the Pacific have their gulf streams. These liberate their warm, vapor-laden currents on the shores; and thus, when the winds are off sea, exercise a happy, moderating influence upon climate. In this regard, Europe is favored in an especial degree.

The isothermal lines traced upon the maps, indicate only the general average temperature; for as ordinarily recorded, the mean temperature of two places in the same latitude near together, vary greatly; and the temperature to the windward of a city differs from that to the leeward. As is done by signal service officers, the thermometer should be exposed at considerable height, in order to insure greater uniformity of results. But, since temperature is influenced by the degree of humidity quite as much as by latitude, etc., it is obvious *that the correct mean for any particular locality can be obtained only by the use of the wet and dry bulb thermometer.*

In 1866, Col. R. Strachey first called attention to the fact that the intensity of the heat of certain climates was owing to the paucity of atmospheric moisture; and the relative humidity has a controlling influence upon the extent of the daily range, this being greatest when the air is dry, and smallest when the air is moist. As the result of numerous practical observations by Col. Strachey, Dr. Livingstone, and others, this point has been set at rest. Central Australia furnishes a

[1] Nation, October 27, 1886.

[2] For experimental data to establish this dictum, see House Plants as Sanitary Agents, p. 229, by author.

striking example. "The heat of the air is described by Capt. Sturt as fearful during summer; thus in about latitude 30° 50′ south, and longitude 141° 18′ east, he writes, 'the thermometer every day rose to 112° or 116° in the shade, while in the direct rays of the sun, from 140° to 150°.' Again, at a quarter past three P. M., on January 21st (1845), the thermometer had risen to 131° in the shade, and to 154° in the direct rays of the sun.' . . . . . In the winter the thermometer was observed as low as 24°, giving an extreme range of 107°." Similar illustrations of extreme variations in the markings of the thermometer are presented by the meteorology of Central Africa, Calcutta, and to a striking degree by India. In the latter instance, at Jacobabad, during the month of June, after the southwest monsoon has begun, the mean daily range of temperature is about 10° less than during March, when the drift of wind in Western India is from the interior toward the sea.

But the question of the absorbent and radiant power of the atmospheric moisture, as well as that of numerous other bodies, was set at rest by the ingenious experiments of Professor John Tyndall.[1] Among the gaseous bodies most powerful to absorb and radiate heat are ozone, olefiant gas, boracic ether. To the human race, however, the most important substance investigated was the aqueous vapor in the air—a transparent gas which in small, though variable amount, is everywhere diffused through this medium. Professor Tyndall found that the aqueous vapor contained in the air of the room in which his experiments were made, exerted an action on radiant heat seventy-two times greater than did the air itself. This at once establishes the fact that watery vapor is a prime factor in meteorology, the extent of the fall of the thermometer being determined by its presence. The physical properties of atmospheric vapor before alluded to, have also an application of peculiar sanitary significance. A proper degree of saturation of the air, if it be uniform, must tend to produce an equable climate, with slight daily fluctuations in the temperature—a state of things which is of far higher importance to the public health than the question of the general average temperature of the four seasons. Hence, there are climates which have a favorable average temperature for the year, but are nevertheless trying on account of frequent variations in the degree of saturation, and a daily range of temperature not less changeable. Such a climate as this, no matter in what latitude it may be found, is unwholesome in the extreme. On the other

[1] Space would fail me were I to attempt to give Professor Tyndall's methods.

hand, a comparatively dry climate which may be found to go hand in hand with great nocturnal fall of the thermometer, may yet be healthful, provided that these conditions are regular in their manifestations. Prominent among instances of this sort, we may mention Canada, which lies between the Lawrentides on the north, and the hills of Notre Dame on the south, from two to four thousand feet high, though the province itself has a low altitude, which greatly modifies the climate. Heat and cold are here easily borne, a fact that is easily explainable, when it is recollected, that the climate of Canada is regular. Further than this, Professor W. H. Kingston[1] has pointed out some interesting beneficial effects of this climate upon the European races, as well as upon certain forms of disease. "The death-rate," he tells us, "is small, except in early life, but this latter fact is due to the enormous birth-rate." There are no diseases indigenous to Canada; phthisis is also favorably influenced in its course by this clime. Moreover, Kingston states that as to the question of physical type, the European races in Canada are undergoing general improvement.

Dryness of the air or the opposite condition of pronounced humidity are, either of them, less objectionable in any given climate, if these phenomena be equable, than if they be subject to marked variations, with respect to these meteorological elements. Equability then is the most important climatic factor for the public health and welfare; while, as before intimated, on the contrary, a variable degree of humidity has a preponderating influence for evil. To stop here, therefore, and inquire what are some of the chief influences which coöperate to produce an equable climate, would be quite pertinent. Among the conditions favoring a regular climate, that is to say an equable humidity and temperature, we should mention geographical position or the physical geography of a region—*e. g.*, Canada; favorable wind-currents, more particularly those softening winds before referred to, arising over the Gulf stream; and, to some extent, the degree of latitude. But a leading consideration, though not usually referred to by writers upon the present theme, is the climatic influences of forest growth. Forests exercise a favorable influence by offering resistance to the free passage of objectionable winds, thus ameliorating the midsummer heat on the one hand, and the severity of winter on the other. When properly located with respect to the regions whence come vapor-laden currents, they also form excellent barriers, and in this way serve as admirable

[1] Influence of Canada Climate on European Races. Report of British Association for Advancement of Science for 1886, p. 843.

regulators of atmospheric humidity. The chilly spring and autumn winds, which usually carry an abundance of moisture, have their force broken and their ill-effects happily modified by this mechanical action on the part of growing woods. Again, the sea breezes, which on reaching the land become warmed, while their capacity for moisture is greatly increased, thus naturally exercising a decided parching effect, are rendered comparatively innocuous by means of a proper ratio of wood-land along our coasts.

But the chief effects of forests, from the standpoint of climatic sanitation, is that exerted upon the degree of saturation. The only physiological function to which this influence can be ascribed, is transpiration, or the evaporation of watery vapor from the leaves of the trees. Although the fact may appear remarkable, we have elsewhere shown that the rate at which aqueous vapor is given off by plants is not less than one and a quarter ounces per square foot of leaf surface for twelve diurnal hours.[1] From this fact alone we are doubtless justified in drawing the *à priori* conclusion, that a fair proportion of wood-land to the total superficial area, exerts a potent influence upon the hydrology of a given district. But, in order to settle this point definitely, further experiments were conducted, and from the data obtained it is safe to infer that where the percentage of wood-land is from twenty-five to thirty, water to the depth of twelve inches is transpired in the course of a season, in a temperate climate.[2]

Forests do not, however, increase the annual rainfall, though they undeniably influence favorably the distribution, during the period of vegetable growth and development, of precipitation. Transpiration, it should be noted, is mainly excited by the action of the direct rays of the sun; while ordinary evaporation from water or soil is controlled chiefly by the temperature and the degree of humidity. From the results of the observations briefly referred to, we are warranted in making two important deductions: first, that the exhalation of moisture from growing forests increases to some extent the degree of humidity in the adjacent air; secondly, that forests maintain a more rigidly uniform degree of atmospheric moisture in their vicinity, and, hence, also, a more nearly uniform range of temperature than is found elsewhere. Obviously, these are cogent reasons why the State should attend carefully to the preservation of her forests.

[1] "Transpiration of Plants." American Naturalist, March, 1878.

[2] "Forests, Their Influence upon Climate and Rainfall." American Naturalist, January, 1882.

Upon sanitary grounds, the atmosphere which we breathe and which constantly encircles us should contain a fair degree of humidity. We are here naturally met with the query, What constitutes the most agreeable and most healthful degree of saturation? According to Parkes[1] the degree of humidity most agreeable to healthy persons is when the relative humidity is between seventy per cent. and eighty per cent. An atmosphere such as this admits of free evaporation from the body, which causes persons in ordinary health to feel comfortable. On the other hand, the abrupt changes in temperature which accompany an unstable humidity, tend to produce a chilling effect upon the human system, with consequences decidedly serious. And whilst a climate such as this is trying to well persons, it is infinitely more injurious in its effects upon all classes of invalids.

Intimately associated with the degree of relative humidity are the causation as well as the spread of certain diseases. Malaria, hygienists believe, only reaches its greatest prevalence in an air containing considerable moisture, a fact which explains the absence of this affection in some dry climes, for example, portions of Canada. Conversely, dryness of the air checks the dissemination of smallpox and possibly other germ affections; and this may in a great measure account for the fact that epidemics of smallpox are more readily controlled during the warm season, when the relative humidity of the air is comparatively low; though this is not the usual interpretation. High authorities are unanimously of opinion that exposure to sudden changes of atmospheric temperature, more particularly from warm to cold, constitute the chief exciting cause of inflammation of the mucous membranes lining the respiratory tract, including bronchitis and the various forms of phthisis. On the other hand, according to the principles before adduced, similar results must follow in consequence of passing rapidly from a low temperature to a higher one with increased humidity. This postulate is well borne out by the experience of many leading practitioners. A moist climate in a cold latitude is also prone to cause the class of ailments before mentioned, more especially if the humidity be variable, though most writers hold that dampness under these circumstances is the most potent meteorological element for evil. But though we are not contending for the wholesomeness of a moist climate, yet we do maintain that a constant, though high relative humidity, which goes hand in hand with a regular march of the daily temperature, is not likely to cause diseases having their seat in the

[1] Practical Hygiene, vol. ii. p. 88.

respiratory organs. The element variability, therefore, exercises the preponderating influence in the causation of this class of common affections.

Unfortunately, a perfectly regular climate does not exist, for various reasons, chief among which, perhaps, is a sudden change in the direction of the wind-currents. As a good example of this character we may cite the strong winds, which in early spring and late autumn suddenly prevail, passing from the great northern ranges at the far west, in an easterly direction, all the way to the great lakes and the Mississippi River to the east. During the same period we have the northeast winds which sweep over the entire area of the immense Atlantic coast. During these seasons, high authority[1] tells us that bronchial affections largely prevail, to which rheumatism, tetanus, and certain nervous disorders should be added. Without the action of cold it is very doubtful if any degree of traumatism would cause tetanus; whilst localities showing an extensive range in the daily temperature record, and those exhibiting fluctuations in the degree of humidity to the extent of causing chilliness of the surface, act as potent predisposing and exciting causes of this fatal disease.

Neuralgia is decisively influenced by climatic conditions, being greatly aggravated by a cold and moist air. The relation of low temperature to spinal sclerosis is, perhaps, not definitely settled; but the vast majority of American authorities concur in the opinion that cold has the effect of intensifying all the chief symptoms of the disease. As shown by Gerhard[2] and Mitchell,[3] the appearance of cases of chorea is to a great degree determined by seasonal influence, the preponderance of instances occurring in the spring time. Mitchell, who has made an exhaustive study of the causes of this disease, does not, however, believe that the degree of humidity exerts so great an effect as storms. To what extent the meteorological elements we are considering assist in the production of hysteria, is not quite clear, but certain it is that hysterical attacks are greatly influenced by season, spring-time being the most favored. Besides those already mentioned there are other nervous disorders on the origin of which the conditions of temperature and relative humidity have some effect, though these influences are either slight in themselves or involved in considerable obscurity.

In briefly alluding to the relations of temperature and degree of

[1] Dr. N. S. Davis in American System of Medicine, vol. iii. p. 168.

[2] Quoted by Sinkler, American System of Medicine, vol. v. p. 444.

[3] Lectures on Nervous Diseases, p. 128.

saturation to the climatic treatment of disease, it should be pointed out that, from the facts previously adduced, it is indisputable that the true advantages of any particular climate cannot be definitely stated, unless along with the records of mean temperature, that of the relative humidity be simultaneously noted and fully considered. Unfortunately, such records are wanting even in some regions where widely reputed health stations exist; or, where such observations have been made, the climate has not been studied with sufficient regard to the results from the use of the wet and dry bulb thermometer. Climates, considered as here advocated, would resolve themselves into such as are regular and such as are irregular; and these terms should invariably be employed in describing climates. A cold climate, *per* example, should be depicted as either cold, dry, and regular, or cold, moist, and regular, on the one hand, and cold, dry, and irregular, or cold, moist, and irregular, on the other. Warm and temperate climates should be classified in like manner.

The facts brought forward in the present discussion seem to justify the following deductions:

First. The mean daily temperature range is to a large extent determined by the degree of saturation.

Secondly. A regular adequate degree of humidity and slight daily variations of temperature go hand in hand, inevitably producing a regular, healthy climate; a variable degree of saturation, on the other hand, exerting a pernicious effect on the human health.

Thirdly. An equable climate, whether dry or moist, cold or warm, to a limited degree, is favorable to the maintenance of an equable bodily temperature.

Fourthly. A leading effect of forest growth is to produce and maintain a regularity in the degree of atmospheric moisture.

Fifthly. Temperature should not, as is frequently the case, be made the sole basis for a classification of climates, but the carefully recorded relative humidity should also be taken into consideration.

Sixthly. More extended observations with a view of ascertaining what might be termed the daily march of the relative humidity of our various climates would be highly desirable; for the element regularity, or the opposite condition, irregularity, cannot, in any other manner, be precisely determined.

FURTHER CONTRIBUTION TO THE STUDY OF CONSUMPTION AMONG THE INDIANS.

By WASHINGTON MATTHEWS, M.D., LL.D.,
UNITED STATES ARMY.

In a paper published in the *Transactions* of this Society for 1886, entitled "Consumption Among the Indians," I endeavored not only to set forth such evidences as we possessed of the great and increasing prevalence of consumption among the red race of America, but to show that climate was not to be considered as an important factor of this prevalence, thus producing further evidence to establish the importance of the non-climatic causes of this disease. My conclusions on this point were as follows: "If the evidence adduced is admitted to have value, it goes to show that consumption increases among Indians under the influence of civilization—*i. e.*, under a compulsory endeavor to accustom themselves to the food and the habits of an alien and more advanced race, and that climate is no calculable factor of this increase."

When entering upon the preparation of the paper referred to, I well knew that a most reliable basis for a proper study of my subject would be exact statistics from which we could estimate the proportion of cases of, or deaths from, consumption to the population among the Indians; but a careful examination of all the sources of information then available, showed that no such statistics were to be found. I was therefore obliged to rely on what I called the consumption-rate, because in the volume of *Vital Statistics* of the Tenth Census I found material from which to compute such a consumption-rate, and no better material was available. "By 'consumption-rate' I mean the number of deaths from consumption in a thousand deaths from all known causes."

It was well understood that the consumption-rate might easily prove misguiding for a reason tersely expressed by that veteran Indian physician and missionary, the late Dr. T. S. Williamson, who says of the

Indians of Lac-qui-Parle, Minnesota, about 1846: "The great proportion of phthisis was chiefly owing to so few dying of other diseases;"[1] and had the *Vital Statistics* shown that the general Indian death-rate was no higher than that of the negro or Caucasian, we might have doubted if more red men than white or black men died of consumption in proportion to the numerical strength of the respective races. But when it was learned from the statistics that both the consumption-rate and the death-rate were highest among Indians, no doubt was left that the ratio of consumptive deaths to population was also highest among the latter people. Again, in comparing one tribe with another, and in comparing for the same tribe one historic period with another, it was believed that the same rule would hold good, that in whichever case both consumption-rate and death-rate were the higher, the ratio of deaths to population would be the higher. While I was willing, however, to accept, for purposes of argument, the general Indian death-rate of 23.6 given in the *Vital Statistics*, as I believed it to be under rather than over the actual figures, I was not willing to accept as good data death-rates from individual tribes which might have been computed from the census reports and the reports of the Commissioners of Indian Affairs, since the facilities for recording deaths vary so greatly on different reservations, and I therefore felt safe in comparing consumption-rates only.

In addition to the information derived from the census reports, I brought forward more from the unpublished records of the Indian Bureau in Washington, from the original manuscript reports from which the census was compiled, and from other sources. The careful comparative study of all of which seemed to sustain the deductions drawn from the *Vital Statistics*.

Since writing my essay referred to, no official reports have appeared from which I could learn the actual number of deaths from consumption as compared to population of any tribe or collection of Indians for any given period. I have, however, in the meantime, corresponded with various persons, who, I heard, were well acquainted with certain tribes of Indians, and likely to give desirable information, and I have collected a number of published essays on the sanitary condition of the Indians, written mostly by physicians whose experience fitted them for the work. From all these sources I have collected additional data, including fairly exact lists of annual deaths from consumption, and valuable opinions concerning its causes.

[1] "The Diseases of the Dakota Indians." Northwestern Medical and Surgical Journal, vol. iv., No. 11, May, 1874.

In my essay, which I have such frequent occasion to quote, this paragraph appeared:

"The following is the consumption-rate among reservation Indians in thirteen different states and territories: Nevada, 45; California, 70; Arizona, 83; Colorado, 107; Nebraska, 150; Montana, 176; Dakota, 200; Oregon, 240; Idaho, 250; Washington, 302; Michigan, 333; Wisconsin, 361; New York, 625."

I introduced this table merely in order to compare the consumption-rate of the Indians with those of the entire population (mostly Caucasian) in certain limited areas, where climatic influences might be regarded as the same in all parts and for all races; but I appended the following passing remark:

"It is seen in the foregoing table that in the States east of the Mississippi—the oldest States—where the Indians have been longest under civilizing influences, the consumption-rate is highest."

This was not intended for a general conclusion, but was an expression called forth by the figures of the table. At the time it was written it was not supposed that on closer investigation it would be found that the Indians longest in contact with civilization, generally suffered the most from consumption in proportion to population, and it was thought that the high consumption-rates of the given table might be found to depend largely on immunity from other diseases; but the information since gathered has not sustained such expectations.

In this table of the consumption-rate among reservation Indians, the tribes of the State of New York stand at the head with the enormous rate of 625, in other words 62½ per cent. of all deaths occurring among them during the census year were from consumption. These New York Indians are a part of the descendants of the once powerful Confederacy of the Six Nations, the Iroquois. Some years ago, Dr. John Gilmary Shea, in conversation, pointed out to me the noteworthy fact that this nation was then as numerous as it was when, over a century before, it held the balance of power between France and England in America. They are not, then, a "dying race," as the Indians are so glibly termed by many writers. Consumption may be their worst enemy; but it does not exterminate them.

In my paper quoted, I make the following remarks:

"It might be supposed that after many years of contact with this civilization, after several generations of the 'survival of the fittest' to cope with the new conditions of things, and after no small dilution of the Indian blood by intermarriage with the exotic races, a state of tolerance to this disease would be produced; but the consumption-rate

of the Indians of New York, seems to indicate that a century is not time sufficient to establish such a tolerance."

As I have thus twice cited the Indians of New York as prime examples to illustrate important remarks, I have taken especial pains to gather further information about them, which information I will now present in order to determine how far it agrees with facts previously collated.

Dr. Jonathan Kneeland, of South Onondaga, N. Y., in a paper read before the American Medical Association, in 1864, says of the Onondaga Indians—a branch of the Iroquois: "The percentage of deaths from pulmonary tuberculosis is very large; many young men and women from the age of fifteen to twenty-two have died, during the ten years of my acquaintance with the tribe, within a year after marriage.[1]"

In a personal letter, dated on the 20th of last April, Dr. Kneeland (now a venerable retired physician of seventy-six years, who since 1864 has added many more years to his experience as an Indian doctor) writes: "You ask me how many deaths have occurred from consumption in any one year. During the year 1877, five; 1867, four; 1869, three; 1871, four; 1859, two. I give the above as samples of the ratio of deaths, though only approximate, as some deaths have occurred in the tribe or among its members while visiting or sojourning with the distant tribes, in whose cases the cause of death was unknown to me." In other words Dr. Kneeland's figures may be less than the actual number of casualties.

It will be observed that in the five years (covering a period of eighteen years), mentioned by Dr. Kneeland, the deaths from consumption increase in numbers as the years advance. But since we have no statistics for the intermediate years, and cannot say what fluctuations may have taken place in the mortality of consumption during the entire period, we will pass on to consider the certain inferences to be drawn from Dr. Kneeland's statistics.

Dr. Kneeland further informs me in his letter, that in population "This tribe varies from three hundred and ten to four hundred in the last thirty-four years, and its apparent increase or decline is a tide which ebbs and flows from other tribes." The deaths from consumption during the four given years nearest the census year, average four per annum, which is one per cent. of the maximum population, or 10 per thousand. In the year nearest of all to the census year (1877),

[1] "On some Causes tending to promote the Extinction of the Aborigines of America." Transactions of the American Medical Association, vol. xv., Philadelphia, 1865.

it is 5 per annum, which equals 12.5 per thousand of the maximum and over 16 per thousand of the mimimum population. Compare these figures with those of the *Vital Statistics*, from which we compute the mortality of consumption for all the Indians of the United States at 4.3 per thousand of population, for the entire population of the United States at but 1.8 per thousand, and for the whole population of the State of New York at 2.4 per thousand, and with all reasonable allowance for inaccuracies in the statistics and for other complications in the problem, we have a startling record of the prevalence of consumption in one of the most civilized and prosperous tribes within our border, a record which, as far as my investigations have carried me, is unequalled by that of any wilder tribe, unless possibly it be by that of the Indians of Crow Creek Agency, Dakota, whose high consumption-rate is quoted elsewhere, but whose rate of mortality from consumption I have not yet learned.

The Eastern Cherokees, living in North Carolina, are a portion of the Cherokee Nation which remained in its old haunts when the greater part of the nation was removed to the Indian Territory, in 1838. They are surrounded by white settlements, and have, next to the New York Indians, lived longer in contact with civilization than any tribe which we have, so far, discussed. Mr. James Mooney, of the United States Bureau of Ethnology in Washington, has made a special study of this isolated tribe of aborigines, and has recently furnished me with some most valuable vital statistics, which he has collected among them. I regret it is not practicable to quote his statistics in full; but I trust they will eventually appear in print. He has ascertained the name, sex, age, and date of demise in every discoverable case of death on the reservation for the past four years and eight months, up to August, 1888. With such definite information concerning the deceased, we may feel satisfied that his mortuary list does not exceed the actual mortality. The following is a summary of the portions of his work which are necessary for our purpose:

Population	1000
Died from beginning of 1883 to Aug., 1888 . .	142
Born	114
Decrease	28
Deaths of which the cause was ascertained . .	38
Deaths from consumption	14

Here we have a band of Indians decreasing slowly in consequence of the excess of deaths over births.

From the above figures we compute the immense annual mortality of 30.3 per thousand and the consumption-rate of 368.4. If to the list of thirteen states and territories given above, we add North Carolina, its Indians would stand next to those of New York in the magnitude of their consumption-rate, and it is interesting to note that they would stand also next in the duration of their contact with civilization.

If we assume, as we not unreasonably may, that the proportion of deaths from consumption, among these Cherokees, is the same in the cases in which the cause of death is unknown as in those in which the cause is known, we have 52.3 deaths of consumption to a population of 1000 in four years and eight months, which gives us the average annual consumption mortality of 11.2 per thousand. This is almost equal to the mortality of the New York Indians, while the Eastern Cherokees have the advantage over their nothern *confreres* of living in a mountainous region.

From other informants, who were kind enough to answer my queries concerning eastern tribes who have been a century or more endeavoring to follow the ways of civilized life, and who were not able to furnish statistical information, I have obtained many observations of a general character, which, though of less value than the statistics, are well worthy of citation here.

Rev. M. C. O'Brien, of Bangor, Maine, in a letter dated July 23, 1888, says of the long-subdued Penobscot Indians, of Maine, among whom he has served for many years as a missionary: "My impression is that consumption is quite prevalent, and the most frequent cause of mortality among the Indians of the Penobscot. The proportion of deaths from this disease is far greater among them than among the neighboring whites of the poorer class. Further, the disease is far more rapid in its course than among any class of consumptives I ever met."

Mrs. William Wallace Brown, in a letter dated "Calais, Maine, August 7, 1888," tells me: "I have just returned from Nova Scotia, ... While there I made some inquiries as to the prevalence of consumption among the Micmacs, and learned that, though the tribe is slightly on the increase, of those reaching maturity about one-half die of consumption. Of course, this was conjecture on the part of my informant, as no record had been kept."

We will now inquire into the causes of this great and increasing prevalence of consumption among Indians.

That it is not specially due to climatic causes has, I think, been sufficiently demonstrated in the previous paper.

It has long been an opinion of mine, and the opinion is, I find, shared by many other observers, that consumption is not so much a primary disease among Indians, as it is a sequel and concomitant of scrofula. In other words, they suffer most from that form of phthisis known as scrofulous phthisis.

True, we have evidence that the wildest Indians in the earliest historic times were subject to consumption; yet they were not subject to it in a high degree, and it is probable that they suffered then from a different form of the malady to that which troubles the modern Indian. But we have evidence that scrofula begins to prevail among them when they cease to live by the chase, and that it is a condition predisposing to consumption among them.

The published article by Dr. Williamson, previously quoted, contains some very instructive observations on this and other points connected with our subject. He labored among the Sioux Indians of Minnesota at that period of their existence, when, by the destruction of their large game and by the encroachments of white settlers, they had just begun to change their diet and habits of life. Recording observations made between the years 1835 and 1846, Dr. Williamson says:

"Of those over ten years of age who died of disease" [violent deaths were the most common in those wild days], "I think fully half died of consumption (phthisis pulmonalis), nor does this seem strange to me, as from your letter it appears to you" [Dr. Stuart is addressed]; "for I do not think it was much more prevalent among the Indians than among our white population; while from the fact that they were all tainted with scrofula, their mode of life, etc., it might be expected that it would be very much more so.

"Notwithstanding the many deaths from violence, while I was at Lac-qui-Parle, the number of births very much exceeded the number of deaths. . . . . Among the women and children who remained in the neighborhood during the winter, scrofula was almost universal; caused by their subsisting entirely on corn for weeks, and in some years for months. Enormous swellings formed about their necks and armpits, and occasionally on other parts of the body, forming abscesses which sometimes so exhausted the system as to prove directly fatal; but more frequently by inducing phthisis or mesenteric diarrhœa. In the spring, when the ducks returned so that they could get animal food, most of them got better, and some entirely recovered.

"Notwithstanding the prevalence of scrofula and much suffering

from want of food and clothing, if it had not been for violent deaths they would have increased in numbers nearly as fast as our own white population."

The Dakota or Sioux Nation was a numerous people and ranged in various bands over a territory so wide that many years elapsed before its middle and western divisions fell under the same influences which proved so destructive to those of the east, in Minnesota, in 1835. Thirty years later the writer visited and observed the bands who lived in Dakota and Montana; scrofula was not then observed among them, and consumption was but little known. But twenty-two years more have passed and we hear, from Dr. Frederick Treon, the following sad account of their unsanitary progress:

"The first diseases to which my attention was directed, when I reached the agency, were consumption and scrofula. Out of all the cases treated, eighty-seven have been of consumption and thirty of scrofula. Out of fifty-seven deaths, forty were from consumption, four from scrofula, and only nine from other diseases, while four were accidental. Thus it will be seen that about seven out of every ten are dying from consumption. In my experience it has been the exception to find among the Crow Creek Indians, who are of the great Sioux tribe, and known as the Yanktonai Sioux—a good healthy subject. I find, basing my belief on the death-rate for the past year, that in less than another century this particular band of Indians will be extinct, and so far as they are concerned, the great Indian problem will have been solved."[1]

Dr. Kneeland, writing, in 1864, of the Onondagas, among whom he has since observed the high consumption-rate to which we have already referred, tells us that "scrofula has set its seal on many adults and most of the children in the tribe, in the form of scars on the neck, and goitrous enlargements or diseased joints."[2]

Rev. M. C. O'Brien, of Bangor, Maine, in a letter above quoted, speaking of the modern Penobscot Indians, says: "I have always thought that it (consumption), was mainly due to the prevalence of scrofula. Some have thought that this scrofula was due to the unhealthy diet of the Indians, and their want of skill in preparing their food. At any rate, quite a large number of Indians have scrofulous

[1] "Medical Work Among the Sioux Indians," etc. By Frederick Treon, M.D., Physician to the Crow Creek Agency. Journal of the American Medical Association, February, 1888.

[2] Op. cit.

eruptions in the neck, and many others the cicatrices or marks of former sores."

Among some tribes in localities where we might readily expect to find, or do find, a tendency to lung complications, we see scrofula present with comparatively little pulmonary consumption.

The following extracts from a paper,[1] by Dr. Percy W. Mathews, who had many years experience among the Indians of the Hudson Bay Territory, are instructive in this regard. The people of whom he writes are not, to any extent, encroached on by settlers, their country being unsuitable to agriculture; they still live largely by the chase; they have not a high rate of mortality, he estimates this at from 12 to 15 per thousand, and the birth rate at 44 per thousand; but they use largely articles of European food, the proper preparation of which they do not understand, and in this way they had come, to some extent, under the influences of civilization. He says:

"I will now proceed to classify those diseases which are most fatal. Bronchitis and pneumonia come first, representing 35 per cent. in the death rate. Next, tubercular disease, including scrofula, tabes mesenterica, and pulmonary phthisis, 30 per cent. Heart disease, including rheumatism, 10 per cent. Infantile convulsions, 10 per cent., and various causes, 15 per cent. Before I refer to the first-mentioned (bronchitis), it is, I think, desirable to describe briefly the position and surroundings of York, as indicating possible climatic influence. York is situated on the west bank, five miles from the mouth of the Hayes, and some six miles to the east of the Nelson River, and is surrounded on the northwest and south by maskeg or swamp, with small tamarac growth here and there, and is fully exposed to gales from all quarters, but more particularly the east, a raw, biting wind sweeping over Hudson's Bay. In the month of April, when the snow begins to melt and stagnant pools to form, an epidemic of catarrh, influenza, bronchitis, or certainly some malarial cachexia will very shortly make itself evident, giving rise to dyspepsia, diarrhœa, or dysentery. When we consider the organisms of disease that must evolve from the surrounding swamp by decomposition of both animal and vegetable life, it cannot be difficult to realize at least some poisonous principle at work. And, again, later on, when the sun attains almost tropical power, some epidemic of a very serious nature is certain to develop. I may bear this out by only instancing the month of August of 1883. An epi-

[1] "Notes on Diseases Among the Indians Frequenting York Factory, Hudson's Bay." By Percy W. Mathews, M.R.C.S. Edin., M.R.C.P. (Lond.), etc. Canada Medical and Surgical Journal, March, 1885.

demic of capillary, vesicular, and acute bronchitis attacked upward of 200 people, including 1 case of acute phthisis and 4 of vesicular emphysema; 16 deaths ensued in less than one month—acute phthisis, 1; emphysema, 1; bronchitis, 14."

"*Phthisis.*—Coming next to pulmonary phthisis, it is a matter of some surprise that phthisis is not more prevalent among the Indians, when one takes into consideration that nothing is wanting to exaggerate their strumous habit or develop it more generally as complicated with scrofula. Within the last six years I have had three cases only, one acute phthisis and two tubercular phthisis."

"Before concluding my remarks on tubercle, I may mention that several cases of death have taken place from tubercular meningitis and tabes mesenterica.

"*Scrofula* will now be referred to briefly. Whatever position is tenable regarding its somewhat debated cause, assuredly York can boast (save the mark!) of both hereditary influence and every other excitant, only excepting syphilis. Diseased nutrition in infancy; food insufficient in quantity, innutritious in quality, and badly cooked; want of cleanliness, intermarriage, prolonged lactation (extending to three, four, and five years I have noted, and even longer is reported), nasty living, and, in short, every adjunct to the perpetuating of this terrible bane to humanity. . . . . The Indian child, if weaned early, which is exceptional, is fed on uncooked oatmeal, and often grease, and very soon partakes of its parents' food. Scrofula, without tubercle, so far as it refers to glandular swellings, more or less ulcerations and indolent abscesses, is far from uncommon, and several cases of strumous disease of joints have also come under observation during my practice at York. I have also had several cases of posterior spinal curvature, and one case of anterior curvature. Scrofulous ulcers are also met with, and are most troublesome to treat; the main difficulty being to secure cleanliness in dressing."

Here is an extract from a valuable letter received from Mrs. William Wallace Brown, of Calais, Maine:

"In regard to the Passamaquoddies, I am able to state with more exactness. Prior to the year 1870 the tribe is said to have decreased, very gradually, however, as it was third in point of numbers of the four Wabanaki divisions. In 1876 there were 260 males, 248 females; during that year there were 21 deaths. 1879 the tribe numbered 523, *i. e.*, 272 males and 251 females; 24 deaths, about one-third being children. In 1884 there were 24 deaths; 1885, 26; 1886, 26; 1887, 31; and up to date, in 1888, 20. The tribe at present numbers

530 total, the births being in excess of the deaths. The disease fatal to young and old, yet attacking the young most frequently, is of such a peculiar nature as to bear little resemblance to consumption, as people in general define that wasting disease of the lungs, a cough being rare, except in the aged. I have watched the progress of the disease in patients young and old, Indian and half-breed, and I notice the nearer 'white' the blood the quicker the strength fails. In this malady a general lassitude is first noticed, then irregular action of the heart; soon a swelling appears, oftenest near the neck glands, but I have seen it on upper and lower limbs, the face, hands, and feet. These swellings turn purple and scale off or suppurate and discharge; the body becomes emaciated and the eyes are affected, often resulting in blindness from the lids being swollen over the sight. A case that I watched with much interest the past winter was a lady, aged seventy-eight years, very little white; two grandchildren were sick at the same time, a boy of six and a girl of nine years. The old lady had the usual symptoms, and was ailing some time before a swelling appeared just above the ankle, not unlike erysipelas; by application of one of their native lotions this was 'scattered,' and next appeared on the instep, where it became a most disgusting sore. The cords were laid bare and the jagged edges of diseased flesh were cut away, as if dead to feeling. After a time this healed over, but the appetite failed and the bowels distended. This always happened before dissolution, and is about the only way one may determine the approach of death, as there is no other perceptible change. The boy died the same day as the grandmother. The girl still lingers in a fearful state of emaciation. I do not cite these as isolated individual cases, but just as *three-fifths* of those who die are affected. Phthisis pulmonalis is quite prevalent among neighboring whites, but not to any degree as prevalent as among the Passamaquoddies.

"The Indians rely more on the efficacy of their own remedies in this disease than in any white M.D.'s prescription. And as there is 'no money in it,' the regular practitioner rarely gives the 'cause and effect' a careful study. The cause that induces it is a low state of living—not low morals—and imperfectly cooked food, with exposure to cold and wet by insufficient clothing, which the intermixture of feeble white blood cannot withstand."

There is little doubt that in Mrs. Brown's letter we find a description of phlegmonous scrofulide, and with this disease as the principal cause

of mortality we have for this far-eastern tribe of Indians the following enormous death-rates (fractions excluded):

	Per thousand.		Per thousand.
1876 . . .	41	1885 . . .	49
1879 . . .	45	1886 . . .	49
1884 . . .	45	1887 . . .	58 [1]

We glean from the above letter that even within the last twelve years there has been a constant increase in the mortality of this tribe, and that while consumption is quite prevalent the cachexia seems more prone to express itself in dermal and glandular than in pulmonary lesions.

A well-known fact concerning scrofulous phthisis is thus formulated by Dr. C. J. B. Williams: "Cases of scrofulous phthisis show an early infection of the lymphatic system, and a remarkable correlation appears to be established between the external gland or discharging surface and the condition of the lungs. If the glands are suppurating, or if the fistula be open, or if the carious bone be freely discharging, the lung disease will remain quiescent, and progress may be made toward arrest; but if, on the other hand, any of the above discharges should be checked or cease, the lung disease breaks forth into fresh activity, making considerable advance and extension, nor is this wonderful when we remember that, according to Koch's and other researches, tubercle bacilli are present in all scrofulous diseases, and are to be found in certain discharges, as that from a strumous kidney or from a fistula."[2]

To this correlation may, perhaps, be attributed the comparative immunity from consumption of some tribes which are badly tainted with scrofula; but why such immunity should be found in climates like that of Maine and the western shore of Hudson's Bay, I am not at present prepared to declare.

As a further illustration of the correlation referred to, I will quote again from Dr. Treon, who, still speaking of the Indians of Crow Creek Agency, Dakota, says: "I have noticed that patients that have enlarged glands and scrofulous sores do not, as a rule, have phthisis pulmonalis. I do not consider my experience sufficient to warrant me

[1] For 1884, 1885, 1886, and 1887, I have calculated on a basis of 530 to the population.

[2] Pulmonary Consumption, etc. By C. J. B. Williams, M.D., LL.D., F.R.C.S., etc., and Charles Theodore Williams, M.A., M.D. Oxon., etc. Philadelphia, 1887, p. 262.

in saying this will not happen, but my observation for the year supports the assertion."[1]

It is safe then to say that in studying the causes of consumption among the Indians we must consider those causes which lead as well to scrofula and allied diseases, and the subject which first demands our attention is that of diet.

Dr. Williamson, as we have already seen, attributes the rise of scrofula and consumption among the Minnesota Sioux to a change from a meat diet to one of corn-meal, and elsewhere in his article he says:

"I saw at times many of the Indians of the plains who subsisted at most times entirely on buffalo meat, and they generally appeared real healthy with the exception of sore eyes. Scrofula is certainly less prevalent among them than among such as subsist almost exclusively on vegetable food, and until the buffalo began to fail they were increasing rapidly in spite of the occasional ravages of smallpox and measles."

Although written fourteen years ago, this article of Dr. Williamson's did not come under my observation until the present year, hence it is a noteworthy fact that almost at the same time that Dr. Williamson wrote, I penned remarks concerning another Indian tribe of the same Siouan stock, which coincide so closely with the remarks of the Sioux missionary that they deserve repetition here. I observed my Indians some thirty years later than Dr. Williamson, and from three to four hundred miles further to the west, yet our experiences were gained under similar conditions. We studied hunter tribes of the western plains when they subsisted on the buffalo, and, again, when the receding buffalo-range had passed beyond the borders of their hunting-grounds. My words are as follows:

"Formerly they lived largely on meat. When out on their hunts and war parties they often lived exclusively on it. There were many nomadic tribes around them who seldom tasted vegetable matter, often living for seven or eight months of the year exclusively on meat and preserving perfect health. . . . . When subsisting for the most part on fresh meat, these Indians had the soundest gums and teeth, and no flesh when wounded healed more rapidly than theirs. Lately, however, since the increase in the consumption of bacon and flour among them, and the destruction of their game, there have been many cases of scurvy, a disease which was particularly fatal to them in the

[1] Op. cit.

winter of 1868–1869, and a tendency to abscesses, to suppurative terminations of diseases, and to a sluggish condition of wounds manifests itself."[1] In other words, I might have said "the beginnings of the scrofulous condition are noted."

As already seen, three of my authorities, Mrs. Brown, Dr. Percy Mathews, and Rev. Mr. O'Brien, attribute the scrofula to improper diet, the food being originally inferior in quality, insufficient in quantity, or badly cooked. One would suppose that in the course of a hundred years of residence in the neighborhood of Yankee housewives, the red squaws of Maine would have learned at least the art of preparing the articles of their limited dietary in a manner to render them digestible; but the statements we have quoted indicate that they have not. If such fruitful causes of scrofula persist in Indian tribes, strengthened from generation to generation by an ever-increasing evil heredity, how can we look for an amelioration in the condition of this unfortunate people?

Another fruitful cause of consumption, resulting from contact with civilization, I believe to be improper dwellings. The question will doubtless be asked, Can any dwelling that civilization may offer be worse than the hut or tent of the savage, a protection against neither wind, rain, nor snow? And I answer, yes. The hovel of the ordinary, so-called civilized Indian is far worse than the savage shelter of his fathers. The latter was at least well-ventilated, and when its floor and the ground around it became littered with decaying organic matter, it was destroyed, or removed to a clean spot. If civilization gave the Indian a decent house and taught him how to keep it clean, all would be well; but when it puts him, as it often does, into a single, low, overcrowded, indecent apartment, with one small window, with no ventilation, and with floors of loose planks, under which the dirt of years may accumulate and rot, it feels it has done its duty. I have seen reports of Indian agents in which they proudly boasted of the number of Indians who had during the year been induced to give up their savage dwellings to live in civilized abodes, and I have heard philanthropists in the West, on the other hand, scornfully berate those blind Indians who refused to live in such houses, but stored their corn and stabled their horses in them, and dwelt themselves in their old wigwams. How fortunate for them was their perversity!

My only correspondent who seems to have recognized the disad

[1] Ethnography and Philology of the Hidatsa Indians. Washington, 1877, p. 25.

vantages of these travesties on civilized abodes, is Mr. Edward Jack, of Fredericton, N. B., who, writing under date of July 28th, says:

"I have, of course, noticed the prevalence of consumption among the Indians, and have always attributed it to the fact that they were badly housed during the winter, often in exposed situations, but more especially to the use of close stoves for cooking and heating purposes, with the accompaniments of very bad—one might say no—ventilation. The Indian here, when in his savage state, lived in a conical-shaped wigwam; in the middle was the fire, the smoke being allowed to escape through an opening at the apex of the cone, with the smoke the impure air of the wigwam passed out, and there was a constant circulation of pure air, which does not exist in the huts in which they now reside."

Some observers are inclined to attribute scrofulous disease among Indians to the intermarriage of close relations; among these are Messrs. Mathews and O'Brien, already quoted.

If it be granted that intermarriage of blood relations is ever a cause of scrofula, it is not susceptible of proof that it is a primary cause among Indians. The system of the division of Indian tribes into *gentes*, the absolute prohibition among unsophisticated tribes of marriage within the *gens*, the extension of the title of relationship of the father to uncles, and of the brother and sister to cousins, and many other social institutions of savage life render consanguineous marriages among wild Indians as rare or rarer than they are among our own race. The crime of incest is held in great reprobation among Indians. When an Indian tribe forgets its ancestral customs, particularly when it becomes small and isolated among civilized neighbors, where opportunities for marriage outside of the community are limited, consanguineous marriages doubtlessly often occur; but this condition of affairs does not arise until long after scrofula and consumption have been well established.

Hereditary constitutional syphilis is thought by some to be a prime cause, or, at least, an important complication of scrofula and consumption among Indians. The opinions on the subject are very contradictory. Perhaps it is safe to say that it is a complication in some tribes and not in others. However, that may be, it appears that scrofula is present in tribes where the venereal diseases do not exist, or are found rarely, or only in the less baneful forms. It cannot, on the whole, be considered an important etiological element. It would, perhaps, be safer to say that the scrofula complicates the syphilis. In my own experience I have known scrofulous lesions mistaken among Indians, both by the laity and the faculty, for lues venerea. Among the authors

and correspondents whom I have quoted, some, it will be remembered, regard syphilis as a cause of scrofula, others do not, and others again are in doubt.

Dr. Kneeland says: "Syphilis and scrofula are the ever-present chronic foes of this tribe (Onondaga). Syphilis often appears as a congenital malady, such cases being characterized by the look of old age, which often appears in infants suffering from inherited syphilis; many of these cases attended with eruptions and ulcerations prove fatal."[1]

Of the Yanktonai, of Dakota, Dr. Treon says: "That these people are inoculated with some specific poison one cannot question, a disease that is hereditary and may have its origin in syphilis; and yet I have my first case of an acute attack of that disease or of gonorrhœa to see among them—a most noteworthy fact."[2] That this specific and hereditary poison is essentially scrofula, and in many cases nothing more, is the reconciling explanation of the above rather antagonizing observations.

Most of my hearers, I suppose, will receive with a smile the suggestion that an Indian ever ruins his health with overwork. He is generally depicted as the laziest of mortals. Yet there are careful and conscientious observers who give a different account of him.

Dr. Williamson mentions among the causes of phthisis, in the paper already quoted, as next in importance to scrofula, "over-exertion in order to obtain a subsistence," he continues: "It has been often said, and most people believe, that the Indians lead a very easy, lazy life, but this is far from true. It was supposed and said by persons casually passing through the Indian country, that the men had a much easier time than the women, and it is true that, as in the case of civilized people who labor for subsistence, the men had more time to rest than their wives, that is, were oftener idle. In hunting, however, the toil of the men was more exhausting than that of the women." These are remarks which, from my own experience, I can fully endorse. The hard labor of women in a savage camp is no more than their honest share of the work.

Dr. Percy Mathews mentions "over-exertion" as one of the reasons why "longevity is not often attained" by the Indians who visit York Factory, and a writer (C. H. Farnham) in *Harper's Magazine*, August, 1888, speaking of the Montagnais of Labrador, of to-day, attributes

[1] Op. cit., p. 255. [2] Op. cit.

their "disappearance" in part to "excessive labor in running down the reindeer and moose."

The period when this over-exertion is the most prominent in the history of Indian tribes, within our borders, is the very period when it is most likely to injure—that is, when their game has been destroyed by encroaching settlement and before the government has undertaken the task of feeding them—the period when they are the most poorly fed.

There are many additional causes of ill-health among Indians which have received the attention of different observers ,such as intemperance, insufficient clothing, exposure to inclement weather, and want of proper care when sick, upon which I will not take the time to dwell now, but will only remark that, with the exception of the first, all these causes were present when the Indian was in his wild state and had a low consumption rate. It is in the presence of the scrofulous predisposition that they become active.

But when all is said, and when we have brought forward an ample array of reasons to show why Indians suffer greatly from consumption in contact with civilization, the question still remains: Why do they suffer more from consumption and scrofula than the African race, whose situation, often, as to food, clothing, housing, etc., is not superior to that of the Indians, and which labors under the further disadvantage of living in a much more inclement climate than that which, for countless centuries, has been its home? Temperament may have something to do with this. A depressed mental condition is a potent auxiliary to consumption. The Ethiopian is, under all circumstances, a light-hearted and happy creature; the Indian, on the contrary, is rendered melancholy by oppression and misfortune.

But I am of the opinion that this difference between the red and black races is to be accounted for as much on sociologic and ethnologic, as on biologic grounds. The Ethiopian is a persistent and peculiar type, which declares itself a dozen times diluted with Caucasian blood. In our country, too, the "color-line" has been so long and so distinctly drawn that one, no matter how fair his skin may be, who has the least tradition of African descent about him, is classed as "colored," and so recorded by all statisticians. This usage brings all grades of the race into one statistical class. The well-cared-for domestic servant, the comfortably housed artisan or business man, whose prospects of a long and healthy life are good, is counted in with the poorest laborers and *gamins*, and thus the general mortality rate is lowered.

It is not thus with the Indian. The type is less remarkable and persistent than the casual observer would suppose. I have seen some full-blooded Indians and many half-breeds and quarter-breeds, who, with the hair cut short and dressed in civilized costume, would easily be taken for dark-eyed Caucasians. An Indian is to us only a social entity. Even if we know a man to have Indian blood in his veins, if he speaks a European tongue, dresses like a white man, and abandons tribal relations, we cease to consider him as of an alien race. Of the hundred thousand Spanish-speaking inhabitants of New Mexico and Arizona, there is probably not more than one in ten of pure Castilian blood, and yet what census-taker would think of classing the other nine-tenths as Indians? If the mixture were Ethiopian, these mestizos would all be booked as negroes. A drop of negro blood, with our long-inherited prejudices, is a stigma to the tenth generation, but the illustrious descendants of the daughter of Powhatan may aspire to any honor our nation can bestow. Everywhere, except, perhaps, in the Indian Territory, the better and more ambitious class of half-castes and even of Indians abandon the tribe and become sociologically white men. The reservation is the receptacle for the remainder. Thus it is that our Indian statistics can only give us an account of the less fortunate representatives of the race.

Among the mixed descendants of European and Indian, the influence which the former element, in its strictly biological relations, may have on the power to resist disease, is not determined. This subject requires more study than I have yet been able to devote to it. The evidence so far obtained seems conflicting; but this apparent antagonism may eventually prove explicable on the theory that in the higher social conditions the European heredity is of benefit to its possessor, while in the lower conditions it is disadvantageous.

What I have heretofore presented to this Association is little more than a report of progress. There is much to be learned on this subject, and I am still engaged in collecting information.[1] This much, however, I may now say: (1) that I find nothing in the newly gathered evidence to invalidate the conclusions reached in my first paper, viz: "Consumption increases among Indians under the influence of civilization;" and (2) that, although, of course, no constant or symmetrical

[1] Since the above was written I have received, too late to be incorporated in this paper, valuable letters, with statistical information, from the following persons: Mr. Edward Jack, Fredericton, New Brunswick; Right Rev. Charles Guay, Apostolic Protonotaire, St. Ann's of Restigouche, Bonaventure County, Providence of Quebec; and Dr. George H. Penrose, U. S. A., Post-Surgeon, Fort Totten, Dakota Territory.

ratio can be shown to exist between the rate of mortality and the duration of this influence, yet, in view of all the evidence now before us, we may declare that some of the highest rates of mortality from consumption and other tubercular diseases among Indians, are found in communities which have been longest in contact with civilization.

It will be understood, from what I have already said, that my remarks apply to communities of Indians and their mixed descendants who still maintain the tribal organization, or a social organization apart from whites; in short, to those who are sociologically regarded as Indians; but they are not intended to apply to the tribes of the Indian Territory, a people whose sanitary condition I have not studied.

Before I close, there is one question on which I feel constrained to offer an opinion, without waiting for the further acquisition of information, and this question is: What remedy is proposed for the unsanitary condition of our Indians?

It may be observed that nowhere in this or other papers do I speak of the actual possession of civilization as injurious to the Indian, for, to paraphrase the old couplet about treason, when an Indian prospers, he's no longer an Indian; but I refer instead to the evils resulting from "contact with civilization," from "the influences of civilization," etc. The policy hitherto pursued by our people toward the Indians has resulted in maintaining a certain large and representative portion of them and their mixed descendants as isolated communities of barbarous aliens in the midst of a civilized population, too busy with other matters to try to understand them, and generally too selfish to consider their weakness. The means of leading a successful and healthy savage life has been taken away from them, never again by any possibility to be restored, while the means of leading a successful civilized life has not been furnished them instead. "A little" civilization "is a dangerous thing," particularly to a man who has to struggle against a high civilization.

My studies and observations, so far as conducted, lead me to say that the policy needed is one which will give to this class of our population the best that our civilization affords. By this I do not mean only our ethics and theologies, with which the Indian has long been furnished, but our arts, our varied industries, our hygienic practices, our domestic economies, the duties of our prosaic every-day life. The Indians are forced by circumstances to take something of our civilization; then why not let them have it all? That they have not taken it all is not because of their own unwillingness, as many hold, but because of the obstacles, surmountable only to the most favored, which

our prejudices, our self-interest, our ignorance, our sentimentality, and our resulting laws have thrown in their way.

I claim nothing new or original for these opinions. They are such as have been long held by the more advanced teachers and philanthropists who labor for the Indians; not only held, but successfully acted on during the last two decades in what I may call the Indian schools of the "new departure," of which Carlisle and Santee may be regarded as types. One of the most hopeful signs of the work done in such institutions is that many of the graduates never return to their tribal life, but, feeling able to cope with civilized man, settle down in white communities, and are forever lost to the Indian element. It is only to be regretted that such institutions are not more numerous and more liberally sustained.

Any policy which tends to assimilate the Indian to the white population is, in one sense, but not in a cruel sense, a policy of extermination. Thirty-five years ago the late Rev. Stephen R. Riggs, the renowned Indian missionary and philologist, thus challenged controversy on this subject: "The Indian tribes of our continent may become extinct as such, but if this extinction is brought about by introducing them to civilization and Christianity, and merging them into our own great nation, which is receiving accretions from all others, who will deplore the result?" [1]

[1] Grammar and Dictionary of the Dakota Language.

HEART STRAIN AND WEAK HEARTS.

By JAMES J. LEVICK, M.D.,
OF PHILADELPHIA.

In the paper I am about to read I have put together a few facts and notices of cases coming under my immediate care or observation. The subject is one which has already claimed considerable attention. Were I to give a bibliography, I should name among those who have written on this subject the President of this Society, Dr. Loomis; Drs. Robinson, Kelly, Da Costa, Delafield, Chew, and others.

I became, myself, first personally acquainted with the morbid condition referred to, in my early manhood, in a hurried walk up Mount Washington. This required hard climbing, as any one who attempts its ascent on foot will find. Long before I reached the summit I was conscious of an oppression in breathing, a want of breath in fact, and a distressing ache of the heart, which made me regret the venture. From that day to this, I have never made the ascent of a mountain of any considerable height without a reminder of this occurrence. A similar experience is recorded by Dr. Clifford Allbutt, and by mountain-climbers in the Tyrol, and elsewhere. That a strain of the heart made in this way, or by any other modes of excessive muscular action, even in early life, may leave its effects for years, I have not a doubt.

Hence, I am not enthusiastic when I read of the tremendous strain brought on the heart of the successful oarsman in his last "spurt," by the champion lifter of many hundreds of pounds, or by the prize-taker in the run of so many miles. Nor do I at all sympathize with the craze for climbing mountains, in which so many young men and women indulge.

It is true that in these young athletes the heart and its adjacent tissues are much better able to bear and more readily to recover from the strain than they are later in life, but that, even with them, a permanent injury may be received, I well know.

I have no better name to offer for this morbid condition than that

of heart strain, nor can I apply to the condition which follows the oft-repeated occurrence of these phenomena any title more descriptive than that of *weak heart.*

There is, indeed, a weak heart occurring in the course of, or as a sequence of, acute disease, very different from that to which I refer. It is a condition which we cannot be too vigilant in watching for, or, better, in guarding against. It is notoriously frequent in the parturient woman after an exhausting labor, it is one of the most frequent sequelæ of diphtheria, but it is also not unfrequently a concomitant of pneumonia and of typhoid fever, and I suspect many of us can recall cases in which, after the patient has seemingly passed successfully through these diseases, a fatal result has followed the undue taxing of the heart by the patient too early assuming the erect position.

But the weak heart to which I refer comes on gradually, and after repeated strain, sometimes without obvious cause, though such cases are often associated with a gouty diathesis. More frequently a careful investigation will show that nervous causes, emotional in their nature, and especially those of a depressing character, loss of fortune, or of good name, the misconduct and disgrace of children, have been followed by this heartache. Now, the slightest unusual exertion, the simplest emotion, will bring on an attack, and the temporary stasis of blood in the heart favors the gradual distention, dilatation, and weakening of the heart itself. And yet this dilatation is rarely such as to develop cardiac murmurs. I have known many more sudden deaths to occur from heart trouble, where there was no appreciable murmur, than where there was one. Given, then, the absence of cardiac murmurs, the presence of heartache, oppression in breathing on rapid exertion, going on to dyspnœa, though rarely the dyspnœa of valvular disease, with pain in the epigastrium rather than in the hypochondrium, with eructation of gas, coming on later, and affording relief, and we have symptoms which have long been grouped together under the title of Angina Pectoris, the diagnosis of which would seem to be of the simplest character. And yet the early detection of the nature of these phenomena, so amenable to treatment early, so resistant later, is often neglected. In the first place, the pain is almost always referred by the patient to the epigastrium and regarded by him as a disorder of the stomach. This is confirmed if there be, as there almost always are, eructations of gas, giving relief to the patient. It is a case of dyspepsia, or of "bilious" disorder, and for a long time is treated as such. No lesson should be more early and more emphatically impressed on the mind of the young physician than that he be

not misled as to the real seat or cause of the pain by the place or position to which the patient refers it. Many a case of thoracic disease, pleurisy, pneumonia, and cardiac trouble, has at first escaped detection because the patient, especially if he be a child, has pointed to the epigastrium or the abdomen as the seat of pain. Nor should the absence of the historic pain down the left arm mislead. It is not an essential symptom, especially in the early stages or milder forms of this malady. Unless properly treated and early, the symptoms which have been enumerated become more and more aggravated, and death suddenly occurs. In cases of sudden death occurring to patients thus affected, under my care or notice, the following appear to have been the immediate exciting causes of death. They are noted here that persons thus affected may avoid them:

First. *Walking on slippery, icy pavements* on a cold day. The patient had walked three or four street blocks to church, and died soon after taking his seat there.

Second. *Hurrying to railway station immediately after eating a hearty meal.*

Third. *Driving for some miles a hard-mouth horse.*

Fourth. *Riding a hard-mouth horse.* This patient had been helped by gentle horseback riding.

Fifth. *Sawing off the limb of a tree* in his own park. The limb required some effort to reach; the position was a constrained one. This gentleman had had frequent attacks of this disease with a feeble heart. A violent paroxysm followed this exertion, and he died before medical aid could be obtained.

Sixth. *Hurrying from one steamboat to another, carrying at the same time a heavy hand bag.*

Seventh. *Assisting to carry a trunk* from the railway van to the station.

Eighth. *Shovelling coal* into the furnace in the cellar.

Ninth. *The act of sexual intercourse.* Three cases of this kind have recently come under my notice. In the first, a married man, aged sixty-five, a violent paroxysm of cardiac pain immediately followed this act. The patient lived for more than six months, was liable to severe paroxysms of dyspnœa—which he never had before—and died suddenly as he arose from his tea-table. A post-mortem examination showed the absence of valvular disease, but the existence of a firm fibrinous clot in the ventricle, which was evidently ante-mortem, and which doubtless was formed coincidently with the first severe paroxysm, six months before.

And this leads me to say that I have no doubt coagula, thrombi, and heart-clots not unfrequently form in a prolonged paroxysm of this kind. The second case was that of a gentleman, aged seventy-two, single, and remarkably hale and vigorous for his years, but who had at long intervals attacks of heart pain. After a morning drive, his coachman driving, he "visited"—I use his own words—"a lady and committed venery." He was almost immediately seized with an intense pain near the heart, but managed to walk home, a short distance, and I found him there with a cold skin, very feeble pulse, although he walked forward to receive me. He was immediately put under treatment, but death rapidly supervened. A somewhat similar case is reported of a judge of the Nottingham assizes, who was induced to go home with a young woman of the town, who testified before the coroner that immediately after having had intercourse with her, he turned on his side, gave a groan, and died. I have recently seen in consultation a fatal case of heart failure in a elderly man where the history of the case pointed to this as the cause of death.

A careful examination into the history of this form of heart trouble, leaves no doubt on my mind that it occurs more frequently in cold than it does in warm climates.

It is very frequent with us of the Northern and Middle States. It is appallingly frequent in England, with its cold, wet, and depressing climate, and especially so among the more intellectual classes, and as I have already said is, I believe, often developed in early life by boat-racing, which, becoming now so general with us, has for generations been the practice in the English universities.

While I have no doubt that the direct influence of cold is a large factor in the development of this morbid condition, the easy, careless, indolent life which a warm climate induces may have much to do with its rarity among the Southern people.

Intense cold, occurring periodically, not only predisposes to this condition, but also invites the paroxysm. The terrible blizzard of last winter proved directly fatal to many subjects of this malady, and laid the foundation of the disease in others who, from lack of railway conveniences, were, to reach their homes, compelled to battle with wind and snow as they never before had done. So thoroughly convinced was the late Dr. Ludlow, of Philadelphia, that cold was an exciting cause of these attacks of heart pain, that he proposed to call the fatal cases occurring in winter cases of *cold stroke* as opposed to *heat* or *sun stroke* of the summer.

Alive, then, to the predisposing and exciting causes of this malady,

the treatment becomes a simple, though not always a successful one. And yet, early detected—not misled by the supposed seat of pain and regarded as a gastric disorder—the patient will derive great benefit, first, by the simple avoidance of exciting causes, and secondly, by a change of climate.

I know of no place in this part of the country equal, in the summer time, to that of the Adirondacks of Northern New York. The late Dr. Ely, of Rochester, who suffered in this way, has told me that he found great relief at Saranac Lake, and I have known others much helped at St. Regis. I do not mean by naming these mountainous regions to advise the climbing of mountains, as recommended by Oertel,[1] but in this delicious atmosphere an amount of exercise may be taken, even gentle pulling with the oar, which could not be borne elsewhere.

Next to this, if there be no valvular disease—and the two conditions are sometimes associated—and if the patient be a good sailor, the happiest results may be expected from an ocean voyage and foreign travel. But, before the patient starts on this voyage, a solemn compact must be made with his physician that he will not hurry for trains or carry hand luggage, a practice much more common in England than it is here.

In the English Channel islands, the Isle of Wight, Jersey, and especially in Guernsey, he will find beautiful scenery, a balmy, healthful atmosphere, the comforts of home, and, in Guernsey, at extraordinary little cost. I believe by such a course of treatment, early adopted, and, as has been said, by the avoidance of exciting causes, this condition of the heart may be greatly helped, if not entirely cured, and this too, without the use of drugs, or, if any, those of the simplest character.

Next in value to a change of climate and moderate exercise in a favorable environment, I believe most benefit will be derived from the prolonged use of moderate doses of nux vomica, five drops of the officinal tincture three or four times daily, either with or without the compound tincture of gentian. Nitro-glycerine has been strongly recommended, and doubtless has its value, though it has more than once disappointed me. At the recent meeting of the British Medical Association held in Glasgow, a paper was read on "The Cactus Grandiflora," which, in tincture, was recommended as especially suited to

[1] If I understand the treatment proposed by Oertel, it is not at all intended for the class of cases we are considering, but is rather a system of well regulated diet and exercise admirably suited to the obese, beer-drinking people of Central Europe.

this condition of the heart, and as free from any of the objections which apply to digitalis, strophanthus, and convallaria. This remedy had previously been recommended by Rubini and others. In a violent paroxysm of heart pain, I think we shall all agree that nothing is so promptly effective and, judiciously used, so free from danger, as is the inhalation of a few drops of nitrite of amyl—a much safer remedy for a feeble heart than is the hypodermic injection of morphia, from which I have known fatal results. Digitalis, as a remedy for this and other forms of cardiac trouble, has been largely used, and in expressing my estimate of its value I shall probably differ from some of those who hear me. Until within about twenty years ago or more, it was universally taught that digitalis was a "heart sedative;" that, in its long-continued use, a cumulative effect was induced, which, if not carefully watched, was liable to be followed by fatal consequences. Suddenly there came the announcement that all this was an error, that physiological experiments had shown digitalis to be a heart tonic, and that the cumulative action of digitalis was a delusion, if not a snare. And then came the natural rebound from the old caution, and a generation of physicians has grown up, who, regarding it solely as a heart stimulant, use it with a freedom—I had almost said a recklessness—which I honestly believe is a most pernicious practice, and against which I wish to enter an earnest protest. There is no form of heart weakness in which it has not of late been used, whether it be the chronic form of heart-failure which has been spoken of, the paralyzed heart of diphtheria and other acute diseases—nay, I have even known it administered to a poor, parturient woman, bleeding to death from placenta prævia, whose failing heart it was proposed to stimulate, not by brandy, ammonia, and such well-known remedies, but by—digitalis!

Whether, then, digitalis be a heart sedative or a heart tonic, and I believe under certain circumstances it may be one or *both*, it is a medicine which requires judgment in its use. It is not to be administered merely because the patient has a weak heart. It should never be used until careful auscultation has revealed the condition of the mitral, aortic, and other orifices. If we accept the teachings of modern physiology, that it gives increased power to the heart, we are bound to accept the same authority that, by contracting the arterioles, it increases also the resistance to the exit of the blood from the heart. If we accept the unmistakable authority of long practical experience, we must admit that cases of sudden death not unfrequently occur to patients using digitalis whose death could not be referred to heart disease alone. Such cases teach us that if digitalis be used, the dose

must be a small one if the patient be walking about, that its effect on the pulse must be closely watched, and that if the dose be increased the patient must strictly keep the recumbent posture. They also teach that in *sudden* failure of heart power digitalis is a doubtful, if not a pernicious, drug; that it is never to take the place of ammonia, brandy, oxygen, and other well-known stimulants. In a word, then, while digitalis, rightly used, is a most valuable medicine, we must yet bear in mind that in the hygienic measures which have been named, in the avoidance of exciting causes, in iron, and especially in nux vomica, we have remedies more certain in their effects, more free from danger, than it is.

I am, indeed, quite disposed to believe that in the morbid condition we have been considering, it would be better to dismiss from our practice those medicines which are supposed to act directly on the heart, and to content ourselves with those remedies which act by improving nutrition and giving tone to the general system. For, after all, it is not the heart tissue which is alone affected, or which is the most important factor of the disease. Rather is this to be found in those structures which preside over its innervation, nutrition, and function—those great ganglionic centres, of which we say so much, but know so little—which are, indeed, the Huguenots of pathology, to which everything that is obscure or undetermined in the ancestry of disease is with such complacency and self-satisfaction attributed.

OBSERVATIONS ON THE USE OF TEREBENE.

By D. M. CAMMANN, M.D.,
OF NEW YORK.

A few introductory words may be said equally applicable to terebene and to most of the terebinthinates. The medicinal value of the turpentines was known to the ancients. The benefit to consumptives of inhaling the atmosphere of pine forests has, as Dr. Loomis[1] remarked in a paper before this Society last year, been always recognized, and he goes on to state that the changes attributable to the persistent inhalation of such an atmosphere indicate that it is not only aseptic, but antiseptic. It is probable that this antiseptic element is the peroxide of hydrogen, which has been found present in varying amounts in the air, in rain, in snow and hail, and in different kinds of forests, more especially among pines. That the peroxide of hydrogen is a powerful antiseptic and oxidizing agent, has been proved by numerous experiments.[2] It is stated that each molecule of turpentine gives rise in the presence of air and moisture to a molecule of peroxide of hydrogen, and that is produced in the presence of pine forests in almost illimitable amounts. Doubtless, the peroxide of hydrogen has often been mistaken for ozone, as the tests for the two are similar. The important property of absorbing atmospheric oxygen, generating peroxide of hydrogen, and keeping it stored away for future use, is possessed not only by the oil of turpentine, but by terebene, benzine, eucalyptol, and many other essential oils, all animal fats, and a large number of other hydrocarbons.[3] In the peroxide of hydrogen thus stored away, half of the oxygen is in a form of loose combination, and is readily given off on contact with certain substances, such as pus and blood. In fact, if peroxide of hydrogen is brought into contact with blood without the body, it is decomposed with great violence, although it has been injected directly into the circulation without undergoing

[1] "Evergreen Forests as a Therapeutic Agent in Pulmonary Phthisis."
[2] Kingzett, Lancet, June 11, 1881. [3] Day, Lancet, August 17, 1878.

decomposition, and readily passes without change through animal membranes.[1] Terebene, due to the presence of this powerful antiseptic, has high deodorizing powers, quickly destroying the odor of the most offensive wounds,[2] and it has even been advocated in preference to carbolic acid in such cases.[3] Given internally, terebene is antiseptic, expectorant, and diuretic, relieves flatulence, and is readily borne by the stomach. In cases of pleuritic adhesions, it seems to hasten the absorption of the exudation. Dujardin-Beaumetz places in the order of their relative utility terpinol and terebene first in bronchial affections, and terebinthine and terpine in renal diseases. I have not only found terebene more useful than terpine in diseases of the lungs, but also in renal diseases. It is one of the most satisfactory drugs that I have used for relieving the dyspnœa of emphysema. Its action may be partly due to the relief of the flatulence with which such cases are so apt to be troubled, but is doubtless owing somewhat to the presence of oxygen in a loose form of combination which passes into the circulation and supplies the blood with that much-needed element.

The value of terebene in winter cough was first recognized by Dr. Murrell,[4] of London, and its use in bronchial affections, both chronic and acute, has been indorsed by the few articles[5] that have since appeared upon the subject.

For the past two years I have used terebene in a large number of cases. A report of some of these has already been made; of the others more than forty in number, a few short histories will be given and a brief analysis of the results attained. I am indebted to Dr. F. N. Patterson for valuable assistance in keeping the histories:

CASE I.—K. L., aged twenty-eight years. Waitress.

October 15, 1887. Gives a history of having been ill for three years. Physical examination shows emphysema and bronchitis. ℞ Terebene, ʒss, t. i. d.

22*d*. Cough less frequent and not so hard. Expectoration and dyspnœa less. Urine not increased. After taking medicine feels dizzy and nauseated. Reduce terebene to ♏ xv, t. i. d.

[1] "Mat. Medica." Nothnagel and Rossbach, New York, 1883.

[2] F. T. Bond, Lancet, Sept. 16, 1876.

[3] Cambridge Med. Soc., Lancet, April 2, 1888.

[4] "Pure Terebene in the Treatment of Winter Cough." Murrell, Brit. Med. Journ., Dec. 12, 1885; also "Pure Terebene and Terpine," ibid., Feb. 27, 1886.

[5] "Terebene in Diseases of the Lungs." Cammann, N. Y. Med. Journ., Oct. 8, 1887. "Terebene for the Relief of Dyspnœa." Cammann, Therapeutic Gazette, Nov. 15, 1887. Owen, Brit. Med. Journ., 1887.

November 5. Cough almost gone. Has a feeling of "smothering" at night.

12. Scarcely any cough or expectoration. Used to be very short of breath, but now has scarcely any dyspnœa.

January 3, 1888. Says she has felt quite well, has had no cough since last note, and has not taken medicine. For the past two weeks, however, has again had cough. ℞ Terebene, ♏ xv, t. i. d.

19*th*. Cough and expectoration less. Has a "smothering" sensation over the chest at night. Urine increased.

March 3. Says she was entirely free from cough after the last time she was here until lately, when she caught fresh cold, and returns for the terebene mixture.

CASE II.—J. H. Z., aged twenty-six years.

November 19, 1887. History of illness for two years. Physical examination shows chronic bronchitis and pleuritic adhesions. Six months ago he took terebene, ♏ xv, q. i. d., for several weeks. At that time his cough improved, and the expectoration became less in amount and thinner. Has not taken medicine for several months. ℞ Terebene, ♏ xv, q. i. d.

December 3. Cough, expectoration, and dyspnœa a great deal less. Urine not increased. Feels better in every way.

CASE III.—P. C., aged thirty-nine years.

December 13, 1887. Has had cough for one week. Physical examination shows bronchitis. ℞ Terebene, ♏ xv, t. i. d.

15*th*. Cough less; expectoration the same in amount, but thinner. Urine not increased.

17*th*. Coughs and expectorates scarcely at all. Feels much better.

CASE IV.—H. W., aged forty-eight years.

December 17, 1887. Has had cough, more or less, all the time for the past eight years. Has had attacks of asthma for the past eight weeks. The history that he gives shows asthma, and the physical examination bronchitis. ℞ Terebene, ♏ xv, t. i. d.

22*d*. Less cough at night. Expectoration the same in quantity, but thinner. Urine increased. Terebene increased to q. i. d.

31*st*. Cough better. Expectoration less and thinner. Dyspnœa less. Appetite improved.

January 5, 1888. Still improving. Urine increased.

21*st*. At times better and at others not so well, but on the whole, steady improvement.

31*st*. Cough no better than at first. Thinks that he has taken fresh cold. Dyspnœa very much less. Expectoration less and thinner. Urine increased. Terebene stopped. ℞ Potass iodid., ʒij; liq. potass. arsenit., ʒss.; spt. ether. co., ℥ss; syr. prun. virg., q. s. ℥ij.—M. S.: ʒj, t. i. d.

February 11. Cough and dyspnœa much worse. He asks that he may have terebene again. ℞ Terebene, ♏ xv, q. i. d.

18*th*. Cough somewhat better. Expectoration less. Dyspnœa not much improved. Urine increased.

CASE V.—G. N., aged thirty-nine years.

December 22, 1887. History of illness for six years. Physical examination shows phthisis pulmonalis. ℞ Terebene, ♏ xv, t. i. d.

January 24, 1888. Has been taking the terebene, but not regularly. Cough is much improved. Expectoration less and thinner. Urine increased.

March 29. The terebene benefited him. Lately he has not felt the need of it, and so has not taken it for some time. Returns for more. Does not pass as much urine when he is not taking the medicine.

April 7. Cough a little better, and expectoration thinner.

June 28. Cough and dyspnœa have been steadily improving, and he feels better than he did.

CASE VI.—J. L., aged twenty-four years.

December 27, 1887. He gives a history of illness for the past six months. Physical examination shows bronchitis and emphysema. ℞ Terebene, ♏ xv, q. i. d.

31*st*. Cough and dyspnœa less. Expectoration less and thinner. Urine not increased.

January 11, 1888. Improvement continues.

CASE VII.—L. P. R., aged fourteen years.

January 7, 1888. He gives a history of cough during the winter for several years. Physical examination shows bronchitis with old pleuritic adhesions. ℞ Terebene, ♏ xv, t. i. d.

11*th*. Cough less. Expectoration less and thinner. Urine not increased. Terebene increased to q. i. d.

21*st*. Continued improvement to four days ago. Since then he has been out of medicine, and thinks that he took fresh cold.

28*th*. Cough less. Expectoration less and thinner.

February 4. Continued improvement. Urine increased.

April 21. The cough had disappeared entirely. Now he complains of pain in the chest and the cough has reappeared.

Thirteen[1] cases were of chronic bronchitis, most with more or less extensive pleuritic adhesions. Three were acute bronchitis, ten emphysema, two asthma and bronchitis, ten phthisis, one pleurisy, and one of the third stage of pleuro-pneumonia. Two of these, both cases of acute bronchitis, were cured, one in four and the other in eleven days. Thirty-three cases were improved, most of them markedly, but a few only to a slight degree. Five were unimproved, two of the patients being obliged to discontinue the drug after two or three days, as it produced vomiting. The shortest time the treatment was continued in any case was four days, the longest

[1] Most of the cases were treated at the Demilt Dispensary, New York.

time six months. The average length of treatment was a little over twenty-six days. Most of the patients took fifteen minims and some as much as half a drachm in a mucilaginous mixture four times daily. In all except three the cough was improved, becoming softer and less frequent. In twenty-six the quantity of the expectoration was lessened, in four it was unchanged, and in two it was increased. The latter were under treatment only one week, and it was found in some of the other cases that the expectoration was increased for the first few days and afterward diminished. In seventeen cases the expectoration became thinner and more watery; in six it was no thinner. In the other cases no note was kept in regard to this point. In those troubled with dyspnœa it was diminished in thirteen and undiminished in eight. The patients noticed an increase in urine in nine cases; no increase was noticed in fifteen. In many of the cases the appetite improved. In two cases the terebene caused vomiting, in two nausea, in one dizziness and nausea, and in two dizziness. These symptoms usually disappeared when the dose was reduced. It is beneficial in affections of the bronchial mucous membrane, both acute and chronic. It relieves the dyspnœa of emphysema, it is readily borne by the stomach, and it seems to have a resolvent action on pleuritic adhesions.

INTERPLEURAL PATHOLOGICAL PRODUCTS: THEIR CAUSE, SIGNIFICANCE, AND SPECIFIC RELATIONSHIP TO PULMONARY PHTHISIS.

By J. R. LEAMING, M.D.,
NEW YORK.

The normal healthful pleuræ are free in movement. Their surfaces glide over each other in respiration without sound-producing friction. They cover the lungs and their lobes, the inner costal walls of the chest, the outer surface of the pericardial sac, and the mediastinum. Thep are not only smooth of themselves, but they are lubricated by a natural secretion never in excess and never absent.

Unfortunately, the normal healthful condition of the pleuræ is not what is most frequently found in post-mortem examinations, for seldom are the pleuræ entirely free from pathological results. The early pathologists, finding these conditions of such frequency and without history of illness as cause, looked upon them as normal. It is not yet twenty years since Dr. Flint, standing in the very front of medical renown, whose memory we revere and of whose fame we are proud, in leading the discussion of a paper on pleuritis which I had the honor of reading before the New York Academy of Medicine, said, in effect, and not unkindly, that the profession would not agree with me in my estimation of the causes, pathology, physical signs, or treatment of interpleural adhesions; that they were not discoverable by auscultation, had no effect upon the health of the individual, and could not be reached by medication. There is no doubt that Professor Flint truthfully represented the verdict that would have been given by the profession throughout the world, could it have been taken, at that time. But since then, many advanced pathologists have adopted other views. Sir Andrew Clark, especially in his Lumleian lectures of three years ago last spring, gave a very thorough and clear account of interpleural pathological products, without acknowledgment of any American assistance. My early connection with this subject, if I am

not, indeed, the earliest one to draw attention to it, is, I suppose, the reason that I have been invited to bring it before you at this time.

Laennec and Louis refer to saddle-leather creaking sounds as being due to old cartilaginous adhesions within the pleuræ. But all other râles and rhonchi were believed to be interpulmonary or interbronchial. But the application of the laws of sound points out unerringly their location and mechanism, and furnishes the elements of a correct diagnosis.

Pathological products within the pleuræ are foreign elements, whether they are growths, like cancer, or benign tumors, tubercle, or other neoplasms; or whether they are exudates, the result of inflammation, or of depressed vitality—of which I shall have much to say in this article.

Of tumors or neoplasms, benign or malignant, I shall not discourse, not intending to be exhaustive of the subject of intrapleural pathology, but shall confine myself to the two forms of exudates—sthenic and asthenic, which may influence or cause phthisis pulmonalis.

The interpleural exudates which interest us in this discussion are of two kinds: First, those which are the result of active inflammation, such as pleuritis or pleuro-pneumonia; second, those which result from depressed organic life. The first is the one generally had reference to when the subject is under consideration.

At the discussion which followed the very able papers before the New York Academy of Medicine, led by Dr. Westbrook, on the subject of interpleural exudations as causes of consumption, the sthenic was the only form considered. That lowers the organic life by its mechanical pressure upon the organs, shutting off the circulation by closing the capillaries for nutrition and for aëration of the blood in the lungs. There is more or less natural tendency to remove this foreign factor by the absorbents, and the effort is successful or not according to the degree of vigor of the organic life in the body.

There is no question that they depress the vital force mechanically; but they have no other phthisical tendency. Such seemed to be the apprehension of this subject by the New York Academy of Medicine. But there is another cause producing exudation within the pleuræ which is not preceded by inflammation or rise of temperature. Indeed, many times the temperature is subnormal before and at the time of its exudation, which soon commences to contract, and the temperature to rise, or to vacillate from below to above the normal. This cause is within the life of the individual, is a part of it, and is immaterial; while the first causes are exterior to the life and are material.

There is a trinity of life in man: The organic; the intellectual; the moral or responsible.

Life, like heat and electricity, is known only by its manifestations. Let us study the beginning of these manifestations of organic life, as Harvey did with the eggs of the hen during incubation. After the first day, upon opening the shell, it was found that the relative positions of the yolk, the white, and the germinal spot or eye were changed, and that the white began to be a little turbid. This was the first manifestation, and proved that the hen had been with the cock, for the eggs of the hen which had not been with the cock did not show these changes. In them were no manifestations of life, and there was no life, for an unfertilized egg is dead. In the fertilized egg before incubation the life is inchoate, and by incubation it is warmed into manifestations. At the end of the second day the changes are still more marked, and at about the beginning of the third day a little point of red appears in the germinal spot, pulsating. This is the beginning of the circulation of the blood before there is a heart, proving that the rhythm and pulsations are primal manifestations of organic life, which then commences to build—first the right auricle and ventricle, and afterward the left heart. Finally, the arteries still shooting out, the whole body is formed in completeness. This organic life—the builder, is immaterial. It uses the prepared organism of the egg as the mason does the brick and mortar, the stones and cement provided for him. It shapes the building in form and for use.

The immaterial essence which results from sexual congress, and which builds the material body, preserves its identity as an individual from the moment of conception until its final death, or until its manifestations cease in the material world. But as organic life always manifests itself in form as well as in motion, we see the spermatozoa of the male with its distinctive form and locomotion by which it reaches the ovum of the female and is destroyed and a new creature begun.

In the fable of Dionysius or creation, representing in Greek mythology desire or love—"Semele, Jupiter's paramour, made him take an inviolable oath to grant her one wish, whatever it might be, and then prayed that he would come to her in the same shape in which he was used to come to Juno. The consequence was that she was scorched to death in his embrace."

The form of the individual continues during life, modified by age, accident, or disease—also the form of the organs, the members, and the constituent parts, the blood-disks, the cells of all the tissues, and the secretions. Everything that has life has inherited its form, its

limit of age, and transmits the same to its children—not only the essential inherent qualities of the individual but, many times, acquired peculiarities. So that disease forms and tendencies may also be inherited—not the material, but the immaterial.

The building material in each individual is introduced into the blood from the digestive organs, and is vivified and used to build or repair the form, which, as it grows old and dies, is thrown out of the system, and fresh, new material takes its place. The life and form continue, and are continually modified by time until the limit of the age of the individual is reached, when formation ceases and form decays. The most absolute proof of the immateriality of life is its death; because the dead body is proof of its former life. The excellence of Lord Byron's beautiful simile in "The Giaour," in the description of "Greece, but living Greece no more," depends upon the appearance of form simulating life:

> Before decay's effacing fingers
> Have swept the lines where beauty lingers.

Bone is the evidence of the once living animal. Hamlet, with Yorick's skull in his hand, reasons upon the former life of its occupant until his "gorge rises," and he puts it down in disgust, but goes on in his illustration by citing the dust of Alexander and that of Cæsar in decay, and suggests the vile uses to which they might come. Wood is the evidence of the life of the tree, and of its growth from the seed; the identity of the life remaining ever, for the wood was always cedar, mahogany, or oak, as was the seed from which it sprang. The life remained, although it often changed particles—the particles which it took up from the ground and assimilated always making cedar, mahogany, or oak, never losing identity, for a thousand years or more, a continual evidence of the immateriality of life in the tree as in the animal. And the wood remains the death-evidence of the life of the tree for thousands of years afterward.

The diamond, the ruby, or the sapphire are evidence of the immaterial Creator. "The earth was without form and void." Divine creative energy flashed through these elements and crystallized them into gems of particular form, brilliancy, and hardness, or of rocks enduring, or of ores of precious metals, where they ever remain evidence of the eternal immaterial existence of the Creator. The crystal, the tree, the animal, represent the primal creation.

Man is mortal—the race immortal. There is an endless succession of individuals, each filling his allotted time and then giving way for

his successor. Each constituent molecule is mortal, like the individual man. It has its limited time of existence, and then passes away and gives place to a new one—and the succession goes on during the existence of the individual. It has its predecessor and successor, and with them its acquired tendencies to disease. These are laws impressed upon all organic life—heredity and endless succession. The organic life, besides pervading every constituent part of the body, has its particular home in the great sympathetic nerve. A connected series of ganglia near vital regions massed together in plexuses are reservoirs; each ganglia, however, is in a measure, independent, yet all are joined in sympathy with each other and with the unity of the individual. Filaments accompany each artery, vein, and capillary. The organs of special sense, the heart, lungs, kidneys, liver, stomach; of digestion, of secretion, of generation; even the brain, which itself was created for the home of the intellectual life, is in every part of it supplied with organic life. The brain could not emit a single thought or emotion without the active assistance of organic life. We learn of the intellectual life through its manifestations. The feeblest brain-effort of the newt to its highest development in man is recognized only by its manifestations. Both the newt and the man seek their food, defend themselves from danger and attack, and propagate their kind. Their intelligence differs with corresponding differences of brain-development. The chief manifestations of the lower animals are locomotion with definite purpose. In man the manifestations are of greater extent and greater power, with the capacity for improvement by education. But what distinguishes man from all other animals is a manifestation of another kind of life —a moral life, or conscience. The manifestations of this new life may be very feeble, but they are distinct, and the power admits of education, like that of the intelligence. It is quite certain that each may be educated separately or in unison; but, if separately, resulting in a moral monstrosity. The trinity of life in man may be thus stated: First, the organic (the builder)—the life of the body; second, the intelligence—the life of the soul; third, the conscience—the life of the spirit; body, soul, and spirit all immaterial—each known by its manifestations only. The evidence of the immateriality of the life of the body is in its manifestations as builder. We could know nothing of them but by building the form of the material body in all its parts, and as a whole; its mysterious conception—intra-uterine existence and birth, and independent life through the periods of infancy, childhood, youth, manhood, old age, and natural death. Intellectual life commences after birth, noticing outside objects, learning its relationship

to the outside world, feeling pain, showing pleasure, fear, or joy. The manifestations increase with the growth of the body and the successive stages of periods of age, until decline and death. The soul, too, grows old. Its habitation, the brain, is part of the body; and as the body grows feeble by age, the intellect must give feebler manifestations, according to the waning power of the body, and the brain, its instrument.

The manifestations of the spirit commence only when the soul upon which it depends has arrived at some degree of capacity for intelligence. All human laws recognize this fundamental truth, for the child is not held responsible for its acts until it has arrived at the age of discretion. Responsibility is measured by intelligence. Intelligence is limited by the development of the body. This delicate interdependence may become deranged at any time during the life of the individual. It is frequently temporary, as in fevers, or in intoxication from medical agents, or commonly by alcohol; or may be more or less permanent, as in pathological conditions of the brain, or reflex, in sympathy with organic disease in some other part of the system of organic life. This higher development of the animal in body and soul, with the added form of spirit or moral life, belongs alone to man. "Conscience makes cowards of us all," is an appreciation by the poet of the spirit's power, for good or evil, over the physical organism. It dominates with controlling force in nutrition, in pathological conditions of atoms as observed in the intimate structure and in the blood. This power is in contradistinction with the outside agents which affect the life of the body—such as poison of different varieties brought in contact with the organic life, externally or within; or miasma, which is simply another form of poison; or microbe, especially the bacillus tuberculosis. The *modus operandi* of these agents is difficult of explanation, but the practical fact remains that tartarized antimony will cause emesis, or that croton oil will produce catharsis, and that other agents the same or similar effects or different ones, and that we make use of our experimental knowledge of them in the treatment of diseases. Again, it is just as difficult to explain how the *materies morbi* which may come to us in the air which we breathe or in the food we eat—miasmatic or microbic—should always produce in the organism the same diseases. There is nothing *a priori* in the constitution of the *materies medicatrix* or of the *materies morbi* which will explain their peculiar and characteristic effects upon the living organism. We are forced to the conclusion that the peculiarity of the invariable effects of these exterior agents is not in the agents themselves, but in the organic life—for if the life has gone out of the body, these agents have no

similar effect. Calomel or other preparations of mercury applied to the dead body produce no characteristic effects, as they invariably do when applied to the living organism. And so with all other medical agents or poisons, or disease-germs. They are exterior causes which have power to influence the interior life of the body for health or for disease. But the spirit is a potent factor in preserving health or in causing disease, and its action is not less mysterious upon the organic life than is that of the *materies morbi* or the *materies medicatrix.*

This interior cause which dominates the life of the body through the life of the soul, although depending upon them for its life, controls their healthful manifestations when benign, or of disease and death when malign. It may cause death of the body by first causing death of the atoms, instantly or successively. When malignly influencing the atoms, causing their immediate or successive death, it gives rise to diseases of the body similar to those produced by the *materies medicatrix* or *materies morbi.* With the tissues and circulation filled with these dead and diseased atoms, the organic life attempts their expulsion by crowding them through the walls of capillaries into the natural cavities of the body, notably the pleuræ and the cellular tissues. They are not all dead atoms, but diseased, and when thrown out of the systemic circulation they still have enough vitality left for organization, imperfect though it be. The immediate action of this pseudo and imperfect organization is to contract, and in this manner to cripple the functions and manifestations of the organic life in local areas of the physical body. The pleural cavities are the great dumping-ground of the organic life. Here pathological products are more frequently found, and when of much extent their contraction mechanically closes the capillaries of the lungs upon their surfaces, preventing largely the aëration of the blood, and, all of the malign causes continuing to operate, the disease becomes progressive fibroid phthisis. The temperature, perhaps, always is subnormal in the earliest stages of exudation. But when contraction commences after adhesions, the local irritation causes the temperature to rise at irregular times, and vacillates from below to above normal. It is frequently a sign of organic feebleness and a losing struggle in the battle of life.

Physical and pathological conditions similar to these followed the severe storm of last March in New England and New York, known as the blizzard. It will be remembered that the temperature was low—about zero—and that the winds were very high and the atmosphere loaded with fine particles of ice. The result was, many times, disastrous to those obliged to travel on foot for any length of distance.

The exertion was constant and violent; breathing very much interfered with, on account of the fine snow or frost filling the air. This, with the vital depression consequent upon the intense cold, immediately lowered the organic life of the atoms in the circulation, and death or partial death of these constituent parts of the body took place. Soon after the storm—two or three weeks, in some cases—violent efforts of the organic life to expel these dying and dead constituents became demonstrative. Slight or limited attacks of pleuro-pneumonia of a low type, with hemorrhages, became frequent. These were generally amenable to treatment, but the interpleural pathological products increased *pari passu* afterward with vital depression, and many of the sufferers died shortly—that is, within three or four months—with the genuine conditions of fibroid phthisis as from depressed organic life. The method of death was the same as in that of fibroid phthisis from immaterial interior causes; the spirit acting upon the intelligence causing the disease and death of the atoms of the body in the tissues and in the circulation. Great and prolonged sorrow, deep disappointment, worry, and anxiety—the loss of friends and property, of position, reputation—always cause death of molecules, which being crowded out of the circulation, interpleural pathological products occur which may finally result in progressive fibroid phthisis. When this happens to a wife or husband who has unduly and inordinately mourned the other's loss, it has been ascribed, without sufficient reason, to contagion. The known cause of immaterial vital depression through the conscience is enough to account for the morbid phenomena, without referring to the principle of contagion, of which we know so little.

I have not known of a case of fibroid phthisis in which a distinct history of vital depression could not be elicited by getting the history of the mental conditions of the patient during the preceding year. Sometimes it comes from great sorrows and anxious worry of a few months. Again, it is the result of years of continual unsuccessful struggle in the battle of life—the inability to cope with its great difficulties. Morbid products accumulate in living organisms. The organic life thrusts them out of its dominion, into the pleural cavity, for instance, where a feeble reorganization takes place, which contracts upon the lungs, shutting off a portion of its circulation and crippling its life-power. Here we may notice the great difference between these pathological products and those which result from the sthenic inflammation. These are characteristic in their morbific results, and in this are distinctive of phthisis pulmonalis. It is progressive—the products are constantly being thrown out into the pleural

cavity, until the end. One has an inherent tendency to get well, the other to die, and needs all the assistance of the physician, or of climate, or of food, to arrest its progress.

Management of fibroid phthisis from interior immaterial causation of molecular death, must be rational in order to be successful. The organic life expels the diseased and dead particles, crowding them out of the circulation. The pleural cavities are generally an ample and the most convenient receptacle. The crowded capillaries of the true respiratory system are separated from them only by the thin membrane of the pleuræ. As might be expected, the pleural cavities give the earliest evidence of morbid impressions upon the individual life of the particles or blood-disks. When not overwhelming they are thrown out, ejected from the circulation, until the organic life has recovered from the attack, and the mass of débris is taken up by absorbents and carried out of the system. But if the morbific cause continues to operate, more of the waste is expelled from the blood, and the pathological products become too much for the absorbents to remove; which are soon organized, and commence an independent existence. The diseased atoms in this parasitic mass become not only mechanically obstructing and depressing, but vitally also, by their morbid effect upon the life of the body. Under these great and overwhelming difficulties, the mucous membranes of the bronchia become exuents through which these dead and dying atoms are expelled in the form of mucus, and the broken-down, dying, red corpuscles being added to the diseased white ones, a "hemorrhage" results. If we look at this state of things wisely and calmly, what are we to do? Attempt to resist nature by arresting the "hemorrhage" with ergot, or leave this agent to the gynecologist? For it has no power to arrest a bronchial hemorrhage, but rather to increase it; and, if it were possible, it were undesirable, for then would be retained in the circulation the morbific products which the organic life is endeavoring to expel.

The most rational, as well as the most successful, remedy, is spirits of turpentine applied by frequent washings of the chest externally. This has the tendency to prevent or relieve pulmonary stasis: First, to remove the interpleural morbific exudates before organization has commenced; and, second, to revivify the sick corpuscles, both white and red.

The emergency having passed, we have to deal with organized products which, by continual contraction, are lessening the area for blood-aëration, and progressive emaciation results—consumption.

Spirits of turpentine is still a valuable agent, stimulating the ab-

sorbents and dissipating local congestion, and promoting the health of the blood-corpuscles in active circulation. But, above all things else, it is important to maintain and increase the area of blood-aëration. This is best done by simply breathing rightly, taking in as full respiration as is comfortable, and then holding the breath in for a short moment until the newly inspired air has mixed with the residual air, and has expanded under the rarefaction of the blood-heat. This must be continuous. It must be the all-time breathing; spasmodic or stated periods of correct breathing, of forced inspiration, will not succeed so well, for if the expansion is intermittent, the pseudo-membrane will recontract at every intermission, and the fable of Sisyphus will be illustrated. For this reason, all mechanical methods of expanding the chest, although undoubtedly useful when not violent, are less beneficial than correct breathing which is continual. Change of locality, pine-woods, and mountain-climbing, may all be beneficial.

Interpleural pathology has but a casual or accidental connection with tubercle. Tubercular inflammation, extending to the pleuræ, may cause plastic exudation within the pleuræ, and occasionally tubercle may come independently to the pleural membrane in general tuberculosis. And in this connection only will we refer to the bacillus tuberculosis, which has come to represent the disease. One thing is certain, that wherever a tubercular cavity in the lungs is found, there, in the cavity and in the tissues surrounding it, we expect to find in great abundance the bacillus. Wherever tubercular concretions or aggregations are found, there will the bacilli be also. But sometimes as well, but in far less proportion, where there are dead or dying atoms from mental anxiety or sorrow, scattered through the body, and, of course, in greatest abundance in the lungs, there, too, will be found bacilli. In regard to the question of contagion, or specific causation, of tubercle, I shall not enter. But in regard to its connection with the dead and dying elements within the tissues of the body or in the circulation of the blood, I have come to no conclusion, except that the connection is casual, just as mould comes to decaying animal tissues by natural selection. And mould and the bacillus tuberculosis are suggestive of each other.

ON THE RELATION OF THE NASAL AND NEUROTIC FACTORS IN THE ETIOLOGY OF ASTHMA.

By F. H. BOSWORTH, M.D.,
OF NEW YORK.

The first question that arises in the discussion of this topic is, What is the true pathological lesion which gives rise to a paroxysm of asthma? From the earliest days of medical literature up to comparatively recent times we find all authorities accepting the theory that a paroxysm of asthma is due to a spasmodic contraction of the small circular muscular fibres which have been demonstrated by anatomists to exist in the bronchial tubes even down to their smallest ramifications. It seems rather curious that this theory should not long ago have been questioned. All observers very properly recognize asthma as a neurotic disease, and muscular spasm is undoubtedly a manifestation of the neurotic temperament, and apparently on this trivial ground the theory has been accepted. If the paroxysm is due to muscular spasm, why should the attack occur, in most instances, only at night? Why should it be affected by changes in temperature? Why should relief be obtained by high altitudes? Why should an attack be aggravated by a damp, bad atmosphere? There is everything in the repose of a quiet sleep which should protect one from an attack of asthma, and yet a paroxysm almost invariably comes on during the night. Changes in temperature are not usually recognized as having any marked effect on the nervous system, and yet a change in climate not infrequently precipitates a seizure of asthma. The seashore rather than mountainous districts is favorable to the toning up, as it is called, of the nervous system, and therefore asthmatics should suffer least at the seashore on this theory; yet the converse is true. Again, a paroxysm of asthma is ushered in suddenly, and during its persistence is characterized, it is true, by symptoms which are easily explained upon the theory of spasmodic muscular contraction of the circular fibres of the bronchial tubes, but the culmination of the attack is invariably marked by a more or less profuse sero-

mucous exudation with cough and expectoration. This in no way can be harmonized with the spasmodic theory. I think, then, this view must be abandoned, as failing to explain the clinical history of asthma or the clinical history of a paroxysm. The first to call in question this spasmodic theory was Webber,[1] who demonstrated conclusively, to my mind, that an asthmatic paroxysm was due not to muscular spasm but to a paralysis of the vaso-motor nerves regulating the calibre of the bloodvessels of the bronchial mucous membrane. Under the influence of this vasomotor paralysis coming on suddenly, the bloodvessels in the bronchial membrane assume a sudden turgescence, under which the membrane becomes markedly swollen and congested, thereby encroaching notably upon the calibre of the bronchial tubes, constituting really the first or dry stage of inflammation, although differing from inflammation in that there is no tendency whatever to the escape of leucocytes or the development of the second inflammatory stage. The membrane is swollen, dry, and non-secretive. The result of this swollen condition is to interfere with not only the entrance of air to the air-cells, but also to its escape, giving rise thus to dyspnœa, both in inspiration and expiration. This condition, persisting for a certain length of time, somewhat precipitately gives way in connection with a more or less profuse exosmosis of serum, and the attack subsides. In this theory of Webber's we have one which very completely harmonizes not only with the clinical history of asthma, but with the clinical history of the paroxysm. Furthermore, it recognizes the view that the disease is essentially a neurosis. Medical science has not yet reached the stage where it can tell us in what neurosis consists, or what essential pathological lesion constitutes the nervous habit. That it is dependent on some structural change, I think, cannot be questioned, as all so-called functional disorders are, the term "functional" being simply one which we use to cloak our ignorance of true pathological conditions. If, however, there is any morbid condition which constitutes the individual a neurasthenic, it is vasomotor paresis involving some region of the body. Thus, in what we formerly called spinal irritation, it has been demonstrated that the backache and other symptoms characteristic of the disease are due to weakness of the vasomotor control of the bloodvessels of certain portions of the spinal cord. In the same way, in the disease we call asthma, the essential pathological lesion consists in a weakness of vasomotor control of the bloodvessels of the mucous membrane of

[1] Tageblatt der 45te Naturversammlung zu Leipzig, p. 159, 1872.

the bronchial tubes. If, then, Webber's theory of spasmodic asthma be accepted, as I think it must be, we have gone far toward understanding why there should be a close etiological relation between this affection and a diseased condition of the nasal mucous membrane.

In a former paper read before this Association[1] in 1885 I discussed quite fully the true physiological function of the nasal mucous membrane, and the ultimate connection between that and the bronchial membrane. I need, therefore, but briefly allude here to the views then advanced. The great and important function of the nasal mucous membrane is exosmosis of serum, by which the inspired current of air shall be so far saturated with moisture as that in passing through the bronchial tubes the mucous membrane lining them shall in no way be disturbed by the absorption of moisture by the respiratory current. Furthermore, this exosmotic function is regulated with an extreme degree of nicety through vasomotor control in such a way that the serous exudation shall adapt itself to the various changes of temperature and humidity of the respired air. There is thus established a very close and exceedingly intimate connection between the membrane of the one region and that of the other. I think that much in the same way as the respiratory movements of the thoracic walls are regulated by the so-called *besoin de respirer*, and the demand for oxygen on the part of the blood controls the rate and rhythm of these movements closely and accurately, in just the same way the serous exosmosis from the nasal mucous membrane is regulated to adapt itself to the condition and demands of the bronchial membrane. The blood supply of the two regions is thus brought into very close and intimate relation, and is virtually under the control of the same system of nerves, so far does this sympathy between the two regions go. Very close observation can easily demonstrate that a plethora of the bloodvessels of the nasal mucous membrane tends to develop a like plethora in the bronchial mucous membrane, and, furthermore, that, if we produce an anæmic condition of the turbinated tissues, an anæmic condition of the bronchial mucous membrane tends to follow. Given now still a third condition—that of vasomotor paresis of the bloodvessels of the nasal membrane—the tendency is most marked to the development of a like weakness in the bronchial membrane. This is strikingly illustrated in cases of hay-asthma, which differs in no essential degree from the ordinary spasmodic asthma except in the

[1] Hay Fever and Asthma and Allied Affections. New York Medical Journal, April 24 and May 1, 1886.

exciting cause of the paroxysm. The clinical history of every case of hay asthma shows that the hay fever attack precedes it invariably from one to ten days, the vasomotor paresis of the bloodvessels of the nasal mucous membrane constituting hay fever being followed by the same pathological lesion in the bronchial mucous membrane constituting an attack of asthma. This connection being established, it only remains to establish a connection between perennial asthma, or that form of asthma which is not connected with hay fever, and the ordinary obstructive lesions in the nasal chambers. In a recent paper[1] I made an analysis of eighty of the cases of asthma taken from my own note-books which had been under treatment and in which the records were complete. This analysis demonstrated several points which are exceedingly pertinent to the subject under discussion. With reference to the existence of intranasal disease, such was found to be present in every case in sufficient degree to warrant the conclusion that it exercised a powerful causative influence in the production of the asthmatic attacks. This conclusion of course can easily be questioned, but I think the proof that my view was correct is shown in the fact that of these eighty cases forty-six were cured, twenty-six were improved, three unimproved, and five unknown, and this entirely as the result of treatment of the nasal disorder. The inference, I think furthermore, can safely be drawn that, if the attack of asthma is cured by curing the nasal disorder, the asthma was caused by the nasal disorder. Now, I do not mean to say that nasal disorder is the sole and only cause of every case of asthma. I think no one will dispute the powerful influence exerted by a neurotic habit, which all recognize as present in every case. Let us see what the conditions are which give rise to an asthmatic paroxysm. I think we shall find them covered by the three following heads:

1. The neurotic habit, as best shown in Salter's exhaustive work.

2. A diseased condition of the nasal mucous membrane, as shown by Daly,[2] this consisting simply of some obstructive lesion giving rise to a vasomotor weakness of the bronchial mucous membrane through the intimate sympathy between the two regions already alluded to.

3. Some peculiar atmospheric condition which has never yet been determined, but which precipitates the paroxysm.

The first of these causes is recognized by all. On the second cause

[1] Asthma, with an Analysis of Eighty Cases, etc. American Journal of the Medical Sciences, September, 1888.

[2] Arch. of Laryngol., iii. p. 157.

I have already written in the paper alluded to at sufficient length. I think the existence of the third cause must be accepted on clinical grounds, for, as we know, the paroxysm is dependent on seasonal and diurnal conditions, probably atmospheric. Sir Andrew Clark,[1] in 1886, advanced the doctrine that hay fever and asthma were virtually one and the same disease, a view which I had already advocated in my paper read before this Association in May, 1885, the one disease being vasomotor bronchitis, while hay fever was a vasomotor rhinitis; in the one case the hay fever attack being produced, first, by a neurotic condition; second, a diseased condition of the nasal membrane; and third, the presence of pollen in the atmosphere. The atmospheric condition alluded to above as the third cause of the asthmatic paroxysm is closely analogous to the pollen-laden atmosphere which produces hay fever; but whereas in one case the pollen theory has been absolutely demonstrated by Blackley's incomparable experiments,[2] the peculiar atmospheric conditions which give rise to to asthma have not been determined. Of course, it is not safe to make the statement that every individual of neurotic habit who suffers from obstructive lesion in the nose will necessarily have asthma, and yet I think the conviction would force itself strongly upon any one who was brought largely in connection with cases of this sort that, with these two conditions present, we have elements strikingly favorable to the development of spasmodic asthma, and no slight probability of such development occurring. There is one statement, I think, that should be made in this connection, and that is that I think many cases are overlooked in a mistaken diagnosis of bronchial congestion, slight cold, incipient bronchitis, etc. Asthma is a far more frequent disease, I think, than is generally recognized, and I am very confident that many cases in the earlier stages are overlooked and the diagnosis not made until a well-marked paroxysm sets in with its attendant suffering and distress. Going back to the original topic of discussion suggested in the programme as to what relation the neurotic bears to the nasal element in causing asthma, the conclusion I have drawn I hope is sufficiently clear. Both elements constitute powerful predisposing causes of the disease, and furthermore, from my point of view, a case of asthma in which they are both not present is exceedingly rare. But when we come to consider the comparative relation of the two, I think the importance of the nasal element must be conceded when we consider

[1] International Journal of the Medical Sciences, January, 1886.

[2] Hay Fever. London, 1873.

the question of successful treatment. And this, I think it must be conceded, is accomplished by the removal of any one of the three causative factors—the neurotic habit, the atmospheric condition, and the nasal disorder. Now, the treatment of asthma by general medication—or, in other words, the cure of this disease by therapeutic remedies directed to the control of the neurotic habit—does not present a brilliant chapter in medical literature. In other words, we possess no specific remedy for the disease. The nearest approach to this, I think, all will recognize in iodide of potassium, and yet, if we closely examine our note-books as to the permanently beneficial effects of this drug, our success has not been brilliant. Much less can be said of the use of belladonna, zinc, arsenic, and other so-called nervines. As regards the removal of the atmospheric condition, this consists simply in a change of residence; this, I take it, we all recognize as a temporary measure—the attacks recurring as soon as the patient returns to his former unfavorable atmospheric surroundings.

Turning, however, to that system of treatment which is based on the cure of the nasal disorder, I think I need but refer again to the statistics of my own eighty cases already quoted, which, if correctly compiled—and I certainly made every endeavor that they should be recorded not only with accuracy but absolute candor—the question is sufficiently answered. Basing, then, the question of the comparative importance of these two factors in asthma on perhaps the most important element in the consideration of the disease—viz., its successful treatment—I think it may be fairly claimed that of the three elements which enter into the causation of asthma—namely, a neurotic habit, the nasal disease, and atmospheric conditions—the nasal disorder far outweighs in importance not only the nervous but all other elements of causation.

THE RELATION OF THE NASAL AND NEUROTIC FACTORS IN THE ETIOLOGY OF ASTHMA.

By E. L. SHURLY, M.D.,
OF DETROIT.

In order to divest our subject of all ambiguity, let us establish our first standpoint upon the very simple classification of primary or essential asthma, and secondary or symptomatic asthma.

For under one or the other of these heads all cases, acute or chronic, may be classified, which present that peculiar dyspnœa to which the name *properly* belongs; as we are aware, the etiology of this peculiar dyspnœa has all along been enshrouded in mystery, especially of those cases which have appeared to show little, if any, structural change, and those which have been marked by a peculiar periodicity, known as hay-asthma. For the elucidation of its nature, therefore, many and various theories have been advanced, prominent among which are the *hæmic*, *inflammatory*, *Leyden's crystal*, the *spasmodic*, the *vaso-motor*, the *peptic*, the *nasal*, and other less significant ones.

It will be unnecessary, however, for the purposes of this discussion to notice them historically and in detail. But I must call your attention particularly to the spasmodic, vaso-motor, and nasal, the latter of which has been so ably presented to the profession of late by Drs. Daly, Roe, Bosworth, Ingalls, Mackenzie, Sajous, and others.

Not fully convinced that the more recent and now prevalent ideas regarding the nature of the disease were rationally consistent with clinical observation, I instituted, in the physiological laboratory of the Detroit College of Medicine, a series of experiments upon dogs, and elicited the following information, according to the observation of myself and those who were present: Carefully dissecting out and isolating a portion of the pneumogastric nerve in the neck, a finely pointed electrode attached to a faradic battery was applied, with the result of producing marked contractions of the trachea, bronchial tubes, and

diaphragm; the contractions were both circular and longitudinal, effecting an obvious shortening of these air-passages; in fact, always resulting in a squeezing, so to speak, of the pulmonary organs from below upward; with the fingers could be felt, during the time of shortening, little rugæ, especially along the trachea; upon laying open the trachea down to the bronchi we could *see* the mucous membrane assuming small folds not unlike the *valvulæ conniventes.* For awhile after the application of the stimulus, respiration seemed to become almost entirely suspended, but soon nature, as if operating against this continued danger, would succeed in relaxing the diaphragm a little at first, and then the bronchial muscles, until a slight inspiratory effort took place; and so on, despite the great contractile opposition maintained, a feeble but sufficient respiration was carried on, thus illustrating as plainly as could be the phenomena of an asthmatic paroxysm, this phenomenon was more marked if the stimulation were lighter. These experiments were continued for about a half hour at a time upon each animal, with the same physical effect, and without, in any case, producing any sensible engorgement of the mucous membrane of the *bronchial* or *nasal passages*, or any other result indicating vasomotor paresis.

I may state, however, that the same effect did not follow the stimulation of the carotid plexus, although our experiments in this particular were not satisfactorily made.

The next series of experiments consisted of exposing the *spheno-palatine ganglia*, which, in a dog is difficult to do. In fact, I should not have succeeded but for the able assistance of Dr. J. B. Wright, our demonstrator of anatomy, who is also a graduate of a veterinary college. This ganglion (which it will be remembered presides over the innervation of the posterior portion of the nasal passages) was stimulated as in the other experiments, very carefully, avoiding contact with muscular tissue, with the effect of producing contraction of the nasal, palatine, and upper constrictor muscles, in short, the phenomenon of sneezing; but no contraction of bronchioles took place. The extrinsic laryngeal muscles twitched a little.

Mechanical irritation, such as pinching of the ganglia, produced only slight palatine and nasal muscle contractions.

Following these experiments, we quickly opened up the nasal cavities, and found only very slight, if any, engorgement, and without swelling of the turbinated bodies, and no excessive secretions; I am aware that a few experiments of this sort have been made in Europe, and results published contrary to those obtained by me.

With other dogs I applied to the nasal mucous membrane besides electricity, powdered sanguinaria and an abundance of hay-seed, containing rag-weed probably, two of them being kept for ten days in an atmosphere containing more or less hay-seed, without the appearance of regular asthma, although in one dog there was abundant nasal secretion. I also injected one animal beneath the mucous membrane of the inferior turbinated bone with one-eighth of a grain of pilocarpine nitrate, without the production of any effect, save a slight local irritation and some constitutional debility.

It is, therefore, impossible for me, in the light of physiological experiments which I think were carefully conducted, to discard the so-called spasmodic theory for the more recent one of *vaso-motor spasm* and consequent *blood engorgement.*

If the theory of *vaso-motor paresis* (advanced by Webber and advocated by Dr. Bosworth, in a recent able article upon asthma in *The American Journal of the Medical Sciences*) accounts for the paroxysm of asthma; then, under the influence of an excitant producing such a condition, we ought to find at least considerable engorgement of the vessels within half an hour; whereas, in the experiments stated above, no such result followed. Dr. Bosworth also objects to the term "reflex," in this connection, believing the term constitutes a mantle for our ignorance; while it is undoubtedly true that the term "reflex" is often misappropriated, its use is perfectly justifiable in its application to the disease under consideration; because we seldom know exactly what the *modus operandi* of the cause or causes leading to the paroxysm is. However, assuming, because generally admitted (even by Dr. Bosworth as a fact), the existence of a neurotic predisposition or habit, hereditary or acquired, underlying all cases of asthma; it will be unnecessary to discuss further, whether it be a reflex or direct irritation that precipitates the paroxysm, only that asthma, properly speaking, is essentially a *spasmodic* disturbance of the bronchial nerve-musculature, independent in part of vaso-motor disturbance, and this, it seems to me, can be fully demonstrated.

Coming to the question of *intra-nasal disease* as the foundation of asthma, and also hay-fever, I must take issue with the radical position held by Dr. Bosworth and others. In the first place, I must object to the wholesale condemnation of the noses of asthmatics, which seems to prevail; I believe with *Mackenzie*, of London, that there is no invariable standard of normality concerning nasal chambers any more than of arms, legs, eyes, or ears; what may seem a normal condition for one individual may be abnormal in another. "When the nasal

chambers are open enough to admit of easy respiration through them, vascular enough to warm the inspired air, and bathed with secretion or moisture in proper quantity and quality for such a physiological condition as to give the owner no thought or consciousness of possessing a nose, it is practically a healthy nose;" whether there be slight deflection of the septum or not, or whether a turbinated body presents the orthodox curves, position, and size or not. I have been examining nasal passages more or less for the past eighteen years, and I cannot say now that I have seen many typically symmetrical examples of nature's art in this direction; yet I should be amazed beyond recovery to become possessed of the conviction that in all this time I had seen but few healthy nasal passages, and really *none* possessed by asthmatics. In the last two or three years I have taken pains to examine the nasal passages of many asthmatics, both in hospital and private practice, without observing even a majority with what I regard as diseased conditions of the nasal passages; while the "sensitive area," promulgated by my friend, Dr. J. N. Mackenzie, has also been wanting in the most of those coming under my observation. On this point I am convinced that its occasional occurrence is due to the fact that the nasal mucous membrane of some persons is more sensitive than others, either throughout or in parts, analogous to similar conditions of mucous membranes of other parts, such as the rectum, vagina, and urethra; that it is generally met with in the noses of asthmatics or other persons is contrary to my experience.

That *intra-nasal disease* is a factor in the production or rather prolongation of some cases of asthma, must be admitted, but that it is very often the foundation is contrary to my observation; I am sure that daily experience overwhelmingly shows a very large number of cases of intra-nasal disease presenting hypertrophies, neoplasms, deflections, and other abnormal anatomical conditions in persons of neurotic habit, with a very small proportion of cases of associated asthma, and the same is nearly true regarding "hay asthma." We must not forget the fact that hay-fever and essential asthma are not the same, either pathologically or clinically, although they may coexist; the one is particularly characterized as a constitutional disease with coryza, what may be termed a specific coryza and closely allied to influenza; while the other is a neurotic disease of the respiratory apparatus, non-inflammatory ordinarily, and not accompanied by coryza or rhinitis. The two diseases are undoubtedly allied, and often coexist; there may be hay-fever without or with asthma, and asthma independent of rhinitis or hay-fever. Now, if asthma depended upon intra-nasal disease

almost wholly, we should observe, 1st, nearly all cases of asthma presenting intra-nasal disease and accompanied by rhinitis at first or during the course; 2d, we should observe asthma in a large majority of cases of intra-nasal disease and neoplasms; and 3d, we should be able to produce asthma by experimental irritation of the nasal mucous membrane. That such is not true there is abundant clinical proof.

Lastly, regarding the local treatment of nasal cavities with the galvano-cautery and other caustics in asthma. The valuable statistical article of Dr. Bosworth shows really good results by such methods. I would, however, respectfully suggest that the real therapeutic power of such measures probably lies in the principle of counter-irritation. My reasons are: 1, that blistering and other counter-irritation over the neck and chest, though an old remedy for asthma, is one which in my hands has given as good results as the galvano-cautery; this season I have treated successfully some cases of hay-fever in this way, and also by the application of tincture of iodine (as suggested by Dr. Faulkner, of Allegheny City), with better results than I have had with the saw or the galvano-cautery; 2, the idea of destroying all of the peripheral nerve-ends without wide destruction of tissue seems impossible, owing to the anatomical structure of the parts; for how else can be reached the remote and hidden mucous surfaces of the nasal passages, which contain by far more of the sensory filaments than the parts which can be brought to view. I must confess, the results obtained by cauterization of the mucous surface have not been permanent in my hands, excepting in two or three instances, which may be possibly due to lack of skill or perseverance; at the same time when there are neoplasms or hypertrophies, which really obstruct the nasal passages, the galvano-cautery or some such means ought to be employed.

REMARKS BY W. H. DALY, M.D.,

OF PITTSBURG, PA.

I MAY say, with no concealment of pride, that it has given me great pleasure to view the mass of valuable and pertinent work all over the civilized world that has followed my rather unpretentious record of observations, read before the Congress of the American Laryngological Association in New York, in 1881, upon the subject of hay-asthma in its relation to nasal and neurotic factors. That paper seems to have marked a most important epoch in the study of this subject, for

shortly thereafter followed Hack's valuable work, and J. N. Mackenzie, Roe, Bosworth, Sajous, Allen, and a host of others brought forward their experience—all of them, more or less, verifying the observations I had published, and many of them enlarging and strengthening the views I there promulgated. Some of them, however, possibly went further than I was then prepared to go. But I desire it understood that I am now prepared to go further than I was when I made my original observations. And I am also, as I was then, prepared to concede to others that they are looking into the same truth from a different standpoint, and that I believe they are right, like myself, so far as I go into the complicated and intricate question of asthma and the nasal factors thereof.

Now as to Dr. Shurly's experiments. I have always valued experimental research as being entertaining and instructive. It is, however, subject to being misinterpreted by us, and if so, then it is misleading to a serious degree. I know it has the air of precision about it to look at results that have been arrived at after a careful summing up of observations made upon vivisections of the lower animals; but, as a matter of fact, the suddenly produced objective results on the lower animals are pathologically a vastly different thing from the subjective results of years of complicated diseased action in some of our cases of asthma in the human being. In the latter the nerve factor may be that which is most manifest. But is it *the* factor or the only one through which the medical man must view the pathological process of asthma? I think it ought not to be considered the only one.

Now, gentlemen, we have much yet to learn upon this subject, and I do not believe any of us have ever told the whole truth about asthma, or hay-asthma either. I apprehend the truth is so big that none of us small mortals can take it all in, even in one of our most comprehensive reviews. We are, to a certain degree, like the three blind men in the wise fable of Tolstoi. The blind men came to see the elephant after their manner. They felt the elephant, received their impressions of what it was like, and went away, each with a very definite notion of the appearance of an elephant. But their ideas differed widely. "An elephant," said one of the blind men, "is a kind of whip." He had felt of the tail. "No," said another blind man, "an elephant is a kind of horn." He had felt of the tusks. "No, no," cried another, "an elephant is a great round creature like a ball, and covered with rough skin." He had felt of the side. Each man had touched one little part of the big elephant, and thought that part was the whole. Each man was right so far as he went, and from

his point of view; he began to be wrong the moment he insisted he had gone as far as anybody could go, and knew the whole of it. He began to be not only wrong but intolerant the moment he declared that his fellow, because he differed from him, must in the nature of things be either deceiving or deceived. These men forgot, or did not know, that an elephant was big. That is what was the matter with them. Is it not also the matter with us?

Now, gentlemen, do we not often forget that our truths are big and not easily reached? Do we not oftener spend valuable time trying to prove the fallacy of what another has honestly and correctly observed upon the subject of a big truth, rather than strike out into a new line of observation and add more that is authentic regarding the same truth? I think we too often do this.

I am reminded of the occasion of the first day's meeting in the throat section of the great International Medical Congress at Copenhagen, in 1884, when much valuable time was taken up in the discussion of the relative superiority of inhalations, sprays, and insufflation of powder in diseases of the respiratory passages. The discussion was almost entirely in German, and by Germans, and the burden of it all was the Teutonic enthusiasm with which each champion of either spray, powder, or gas sought to impress the others with its superiority and the utter uselessness of the other measure, until some of us were nauseated into the belief that we were attending a convocation of Teutonic medical men with one idea, and not a great International Congress in which a dozen intelligent and civilized nations were ably represented. These latter remarks refer to the first day's proceedings only, and I am pleased to say the work assumed an international complexion the next day, where every nation's representatives alike had an opportunity to discuss any part of such truths as he was familiar with.

Men get hold of one little corner of a great truth and say, This is the truth. And they listen to another who has his hand on the same truth, but on another side, and answers, "That is error." We are apt, therefore, to allege more for our observations than they are really worth, and indeed, consistent and moderate is the man who alleges only enough. In this connection I desire to say that what allegations were made by me, and what opinions and observations expressed upon that form of asthma known as hay-asthma eight years ago, in a paper entitled "Hay-asthma and Naso-pharyngeal Catarrh," I believe now that I then took one of the blind men's views of a great truth, and told my story of the question as I saw it. But I

have since examined it again and again, and observe more and more, and, with the accumulated experience of eight years and careful observation, I must say that the questions I then formulated are still more strongly tenable in the light of accumulated practical experience—viz., that there is a certain proportion of cases of hay-asthma and also of asthma, and I am convinced the proportion is a growing one, that can be cured by putting the naso-pharynx in a healthful condition.

This, gentlemen, is the corner of the great truth which my hand touches. But I cannot and will not say that my fellow, who appears to differ with me, has not also his hand on another part of the same truth.

REMARKS BY ANDREW H. SMITH, M.D.,

OF NEW YORK.

While agreeing with Dr. Bosworth that many cases of asthma have their origin in irritation of the upper air-passages, I believe there are also many cases having a different origin. There is no single locality which is always the seat of the reflex action. I have a patient, for example, who can bring on an attack at any time by imprudence in diet. A lobster-salad will cause a paroxysm with unvarying certainty. Here the gastric branch of the vagus is at fault. Such cases are by no means rare, and the term dyspeptic asthma is an entirely legitimate one. I am sorry that, in his physiological experiments, Dr. Shurly did not try the effect of irritation applied to the gastric nerve.

I cannot agree with Dr. Bosworth that vaso-motor paresis is the main element in asthma. The very rapidity with which the dyspnœa follows irritation of the nasal membrane in his experiments speaks against the theory of tumefaction of the pulmonary mucous membrane resulting from vaso-motor paresis as the cause of the obstruction. Such tumefaction would require considerable time for its production, whereas the wheezing follows instantly upon touching the irritable nasal surface, thus indicating spasm of the muscular fibres encircling the air-tubes.

Still, I do believe that there is a form of asthma in which vaso-motor disturbance plays a prominent part, not alone by causing tumefaction of the pulmonary membrane, but also by retarding the flow of blood through the capillaries. Dyspnœa results as surely from retardation of blood in the capillaries as from lack of air in the alveoli. Many years ago I observed that, while most patients with asthma

were immediately relieved by the inhalation of oxygen, some were not at all benefited. This, I think, may be explained by supposing that in the latter cases the trouble is chiefly in the bloodvessels and not in the air-tubes; that the patient is suffering, not from a lack of oxygen, but from a lack of blood to carry the oxygen to the tissues. The positive clinical evidence in favor of the existence of the vaso-motor function in the lungs, such as the occurrence of sudden congestion, etc., appears to me conclusive, notwithstanding the negative results of anatomical and physiological researches.

With regard to nasal irritation, I believe that abnormal contact of surfaces within the nose, especially if the contact is accompanied by pressure, will often produce results far beyond what would naturally be expected. For example, I have again and again seen obstinate catarrh immediately relieved by removing the pressure of an hypertrophied turbinated body upon the septum, and I do not for a moment doubt that many cases of asthma can be cured in like manner. I admit this the more readily because I was formerly of a different opinion. But I still think we are going much too far when we seek to establish it as a rule that asthma is to be cured by operative procedures within the nasal cavities. The problem is too complex to admit of such a simple solution.

EPIDEMIC CEREBRO-SPINAL MENINGITIS IN CENTRAL NEW YORK.

By WILLIS E. FORD, M.D.,
OF UTICA, N. Y.

The etiology of epidemic disorders is shrouded in so much mystery that I may be pardoned for dwelling upon this well-worn topic if I can present to the Society any facts which may tend to establish a causative relation between climatic conditions and epidemic cerebro-spinal meningitis.

I shall not attempt to discuss the disorder in a general way, but shall content myself with the relation of such facts as may be said to come properly before this Society. The literature, the symptomatology, the treatment and the pathology may well be discussed elsewhere. In this Society, however, I take it that anything that bears upon the relations of climate to epidemics, even though such facts may fall short of establishing a theory, is nevertheless worthy of mention.

There is an obvious advantage in studying the causation of epidemics in small towns as compared with larger cities, where some form of epidemic disorder must always linger to vitiate statistics. Errors can more easily be excluded in sparsely settled districts, where the physicians are able to secure accurate information regarding all the inhabitants.

In January of this year an epidemic occurred in Norwich, N. Y., a town of 6000 inhabitants, lying seventy miles south of Utica. One of the first cases of this epidemic I was fortunate enough to see, and in subsequent consultations with Drs. Brooks and Stuart, of that place, it was agreed that careful meteorological observations should be made together with sanitary observations.

This work was most carefully and skilfully done, and the result is I believe, a better report than has ever been published on this subject. I was fortunate enough to induce Dr. Brooks to present the details of

this report himself, and shall make my own paper correspondingly short in order to give him the time.

Certain striking facts, especially with reference to atmospheric conditions in producing successive crops of cases in this epidemic, prompted me to collect such facts as I was able regarding other similar epidemics in central New York.

I have obtained accounts of eight other epidemics of cerebro-spinal meningitis in this region. It is, perhaps, necessary to say that the winters of central New York are long and rigorous. The fall of snow is great, and the intense cold lasts from three to four months. Two years ago in Utica there were 150 days of sleighing without a break. If the winter proper begins in the last of November there is usually a thaw or break-up in January, of a week's duration, in which the snow melts and the ground is softened by rain. This is followed by sudden and intense cold, the thermometer ranging from zero to twenty degrees below. The frequency of these thaws determines whether the winter is an open one, as it is called, or not.

Now, if the winter is steadily cold or has but few thaws, the depressing influence of prolonged cold is observed in an increased mortality among the very young, the old, and the feeble, while, if the winter is an open one, influenzas, catarrhal inflammations, and pneumonias predominate, and it is observed that after such a winter typhoid fever is apt to appear. In these nine epidemics the winters were open, and the dampness and rain were noted as the constant and striking characteristics of the season.

As showing the relation between weather changes and the production of pneumonia and sporadic cerebro-spinal meningitis, I have here the record for the last ten years, by years and by months, of all deaths from these diseases, occurring in Utica.

The city of Rome, twelve miles west of Utica, in the Mohawk Valley, has never had an epidemic. During the six years ending May last, there have been thirteen deaths reported from cerebro-spinal meningitis, two being children of eight years, one of fifteen, and the remainder adults. Of these, two were in the month of January, three were in February, one in March, four in May, one each in September, November, and December.

NUMBER OF DEATHS EACH MONTH FOR TEN YEARS, FROM CEREBRO-SPINAL MENINGITIS AND PNEUMONIA, AS RECORDED IN THE CITY OF UTICA, N. Y.

Years.	DISEASE.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total each year.
1878	Cerebro-spinal meningitis	...	...	...	...	...	...	2	...	...	...	...	1	3
	Pneumonia . . .	5	2	...	1	1	1	...	...	2	2	1	2	17
1879	Cerebro-spinal meningitis	1	...	...	1	...	...	...	...	...	...	1	...	3
	Pneumonia . . .	...	3	2	2	4	...	...	1	...	...	...	5	17
1880	Cerebro-spinal meningitis	...	...	1	...	...	...	...	...	...	...	1	...	2
	Pneumonia . . .	3	2	3	4	4	1	2	2	1	1	1	2	26
1881	Cerebro-spinal meningitis	...	...	...	...	...	...	...	...	...	...	1	...	1
	Pneumonia . . .	2	3	1	4	3	2	1	1	...	...	...	3	20
1882	Cerebro-spinal meningitis	1	3	...	...	1	...	...	...	...	...	...	...	5
	Pneumonia . . .	5	1	2	7	7	5	4	5	2	1	4	1	44
1883	Cerebro-spinal meningitis	...	...	...	...	...	...	...	...	...	...	...	...	0
	Pneumonia . . .	2	3	1	8	9	1	3	...	2	2	3	6	40
1884	Cerebro-spinal meningitis	...	1	...	...	...	...	1	...	...	...	...	...	2
	Pneumonia . . .	2	...	7	4	4	2	1	1	...	1	4	1	27
1885	Cerebro-spinal meningitis	...	...	...	1	...	...	...	1	...	...	...	...	2
	Pneumonia . . .	7	5	6	6	7	2	...	1	...	2	2	3	41
1886	Cerebro-spinal meningitis	...	2	2	1	2	2	...	2	...	...	...	...	11
	Pneumonia . . .	6	5	2	9	4	5	6	...	2	3	5	2	49
1887	Cerebro-spinal meningitis	...	...	1	3	...	2	1	...	...	...	...	...	7
	Pneumonia . . .	5	8	6	3	8	3	4	3	4	7	4	3	58
Totals for 10 years, meningitis .		2	6	4	6	3	4	4	3	0	0	3	1	36
" " " " pneumonia .		37	32	30	48	51	22	21	14	13	19	24	28	339

The earliest epidemic of which we have any account in central New York appeared in Richfield, Otsego County, thirty miles south of Utica, in 1852. Dr. Alonzo Churchill published, in 1867, a short account of this in the *Transactions of the Medical Society of the State of New York.* He has recently given me a more detailed account, taken from his notes. This epidemic occurred in a rather sparsely settled upland farming region, the locality being free from malaria; the territory covered included a radius of about ten miles. The sanitary condition of the houses was not noted. The recorded cases establish the fact that it was cerebro-spinal meningitis, and the few autopsies made confirm the diagnosis. There were about forty cases, mostly of the fulminating order, in this little community, mostly children and youth, and the mortality was about twelve per cent. There was no other prevailing illness. It was confined to the late fall months, and disappeared when settled cold weather came on. The

damp, changeable weather which plays such an important part in the production of inflammatory diseases of the respiratory tract in this region, seemed to produce this epidemic, and this new disease took the place of and seemed to exclude everything else.

In 1857 an epidemic occurred on the high uplands in Salisbury, Herkimer County, back of Little Falls, thirty miles east of Utica. This has never been recorded, and I get my information from physicians who saw it. There were about 100 cases, and the mortality at first was very high, though after two months the severity of the epidemic seemed less. It began in the last of December, 1856. The winter, which is usually very severe in that region, was open and very changeable, and such as ordinarily produced catarrhal troubles, though during the entire epidemic there was no other epidemic disease. Dr. H. A. Moors, who furnished much of the information, says: "To the best of my memory, we did not have any severe cases of any disease during the winter excepting spinal meningitis, but under similar circumstances and similar weather we have pneumonia and all inflammatory diseases. As far as I know, there was no cause for the epidemic but the sudden and severe changes in the atmosphere."

The notes of this epidemic are not complete enough to enable me to give the characteristic forms of the disorder, but are clear upon the question of diagnosis. Six months later, in the fall of 1857, there occurred an epidemic of typhoid fever covering the same territory. I can get no accurate statistics as to the number of cases, but the same observer says: "I saw and treated more cases of typhoid fever in the six months than I have ever seen since in any ten years." It was rare that more than one case occurred in a family during the epidemic of meningitis.

In March, 1858, in Sherburne, a small village thirty miles south of Utica, Dr. C. S. Lyman observed an epidemic of eighty cases, and at the time prepared a paper on the subject. The paper was never published, however, and Dr. Lyman has kindly allowed me to use his facts. Of the eighty cases reported, evidently including the abortive type, nine died, not quite twelve per cent. No unsanitary condition of houses is mentioned, and no other epidemic disease was present in the town or followed, and the epidemic ceased with settled, dry weather. The town is on level ground between rather high hills, has no water supply and no system of drainage. The soil, which is essentially the same in all the localities mentioned, is a heavy loam, underneath which is gravel in varying degrees of thickness, and under all is a clay bed.

The thaws and rains of March and April, with but few days of cold at a time, are characteristic of every season in this latitude.

In 1865, in Cedarville and the adjoining town of Litchfield, fifteen miles northeast of Utica, an epidemic began the last of October and lasted about three months. Snow had fallen early in October, but did not remain, and then followed cold rains and very changeable weather. In this rather sparsely settled community of well-to-do farmers about forty cases occurred, but the mortality was not high—about ten per cent. of well-defined cases. The country is an upland, broken region, the elevation being, perhaps, from 200 to 300 feet above the adjacent Mohawk Valley. No other epidemic prevailed or followed. The hygienic condition of the houses in which the disease occurred is reported as good, though how far such a statement can be considered final is doubtful. The next statement is more to the point—that is, that usually but one case occurred in a family, and the "best families" were most often attacked.

In March, 1872, in the village of Frankfort, ten miles east of Utica, in the Mohawk Valley, there occurred an epidemic that was confined to the village itself, and that continued three months, giving fifty cases, mostly children and youths, the mortality being about thirteen per cent. Autopsies confirmed the diagnosis that the epidemic was genuine. In so small a village fifty cases mean one-tenth of the whole population, and, of course, the record of cases is not hard to obtain. Here the dwellings are low down on the ground, and there is no system of water supply or drainage, and the cellars were many of them damp. At this time of year the first general thaw occurs, washing the accumulated detritus of winter into the soil, or perchance into the wells and cellars. In May the epidemic disappeared, and inasmuch as the sanitary conditions remained the same, the weather alone seemed to account for its disappearance. No other epidemic prevailed at the time or followed.

In February, 1873, another sharp, well-defined epidemic returned to the same little village, and attacked mostly those under twenty years of age. There were about the same number of cases. Drs. Parkhurst and Skiff, who observed these epidemics, both say that the mortality was about ten per cent. of the well-marked cases, and that the so-called abortive ones were excluded from the statistics. The disease, the first time, was found on nearly every street in the village, but did not spread to the suburbs. In the second epidemic it did spread to the surrounding territory of, say, a radius of two miles. It has not prevailed since, and no other epidemic prevailed at the time or fol-

lowed. "The weather was cold, but changeable; should say unusually so. Discovered nothing in the sanitary condition of things in the village or in families from which disease would result. The two epidemics were distinct and, I think, entirely disconnected."

In October, 1879, in the town of Winfield, twenty miles south of Utica, a small epidemic—thirty cases—occurred among farmers during a wet, open season, the mortality of which I cannot ascertain, but is given from memory as twelve per cent. of all cases. The account of the atmospheric conditions, however, is clear and to the point: "Severe cold for a few days and changing to warm and then to cold." Dr. Moors maintains that the sanitary condition of the houses was good. This epidemic was cut short by the coming on of settled, cold winter weather.

In 1883, in Canastota, forty miles west of Utica in the Mohawk Valley, there began an epidemic of cerebro-spinal meningitis which was more fatal than any of the preceding ones, and which continued for a period of eighteen months, declining in settled weather, either of summer or winter, to return in the spring and fall when the cold rains and changeable weather came on.

The first cases were late in the fall and were very fatal. These were of the sudden or fulminating type, and the eruption present in nearly every case is described as "purpuric." Sometimes the spots were very small, and sometimes as large as a ten-cent silver piece. Dr. William Taylor, who observed the epidemic and took the notes, writes me: "More than three-fourths of our cases occurred north of the canal on the lowest ground of the village, and in nearly every family where cerebro-spinal fever showed itself there was some faulty sanitary condition about the premises. Damp, unventilated cellars were often present and, as I think, are a very prolific cause when the epidemic tendency exists."

There were several cases in some families, though in no instance were all the members affected. The general type of the disease is characterized by Dr. Taylor as beginning with "shivering, intense headache, or vertigo, or both, and usually by vomiting. Subsequently delirium, alternating with somnolence or a state of dulness or stupor, an acutely painful condition of the whole system with spasms, sometimes of a tetanoid character, of certain groups of muscles, particularly those of the neck."

Of sixty cases one-fourth died, and a small proportion of the remainder were impaired by deafness, paralysis, etc. After the epidemic

proper had disappeared, there occurred an occasional case for four years or more.

In the Norwich epidemic—112 cases, which I consider worthy of a more detailed account—the cases also came in crops developed by cold, rainy, changeable weather, and were checked by steady cold. Twenty-nine cases developed in the quarter section where bad drainage and a generally unsanitary condition were found, as against thirty-six cases occurring in the other three equally large sections of the town proper. The mortality in this epidemic was thirty-three and one-third per cent. of all well-authenticated cases, not including the abortive type. Typhoid fever has now appeared on the same ground, three cases being reported during the last six weeks.

The fair inference from these facts, collected with considerable care from nine small, isolated epidemics, is that cold, rainy, unseasonable weather is the constant factor in the production of the epidemics; that settled, dry weather, either cold or warm, checked the further development of the disorder; that markedly unsanitary conditions tended to increase the number of cases in a locality where an epidemic was in progress, and raised to a marked degree the mortality; that these epidemics were not related to any other epidemic disorder, but seemed to take the place of the usual inflammatory disease of the respiratory tract.

The fact that in two instances out of nine, typhoid fever of an epidemic character followed within a year, though it never preceded, is not sufficient to establish a probability that both disorders are generated from the same or analogous specific germs. North of Utica, in that region known as the Black River Country, extending 100 miles or more, and adjacent to and bordering on the Adirondack wilderness, no epidemic, so far as I can learn, has occurred. This country, including Watertown, as well as several large villages, is well known for the salubrity and dryness of its climate. Typhoid fever is common enough, and other epidemics, such as diphtheria, prevail, but bronchial and pulmonary diseases are rare. Indeed, our patients with pulmonary diseases do as well in much of this region as in the evergreen forests only a few miles to the east. The region is cold, the winters are severe, but the soil, which is sandy, does not retain moisture, and does not allow the evaporation back into the atmosphere which produces pulmonary troubles. The dryness of the climate, therefore, and the purity of the air because the soil does not give back the germs by evaporation, are the chief characteristics of this region.

As to the opinion that overcrowding and bad ventilation, to which

were ascribed the earlier epidemics, as, for instance, in barracks, and which Prof. Hirsch lays down as the reason why epidemics occur most frequently in winter, an opinion endorsed by Dr. J. Lewis Smith in this country, the facts I have brought forward do not confirm it.

Long, severe winters do not produce it. Indeed, the cold weather, which sends people indoors, checks the spread of the epidemic. In the Canastota epidemic, for instance, and especially in the Norwich epidemic, successive crops of cases appeared in the mild, thawing weather, and promptly stopped with steady cold. As bearing also upon this question, the table which I referred to a moment ago gives thirty-six deaths from sporadic cases during the last ten years in Utica, a city with a population of about 45,000, where in certain quarters overcrowding and filth diseases must be acknowledged. November, December, and January—three cold months—only give five cases in ten years, and the disease has never been epidemic.

If it be that a specific germ causes this disorder, and I believe some day this will be established, moisture and temperature not much below freezing seem to be essential to its activity. That the drift of medical opinion is toward the theory that the disease is produced by the pneumonococcus pueumoniæ is certain. Of twelve articles on this subject appearing within the last year, only one author—Richter (in *Breslauer Aerztl. Zeit.*)—considers the disease miasmatic and contagious, though Levick, of Philadelphia (*Medical Record*), considers epidemic catarrhal fever closely allied to it.

I should go beyond the limits of this short paper, however, if I referred to the literature of this interesting subject.

That the mortality is so low in epidemics in country districts is not wholly due to errors in the reported statistics, for it is well known that the mortality from pneumonia and from typhoid fever is much less among farmers than among dwellers in the towns, where conditions of exhausted vitality, either from mental strain or from errors of living, are more commonly found.

AN EPIDEMIC OF CEREBRO-SPINAL MENINGITIS.

By LEROY J. BROOKS, M.D.,
OF NORWICH, N. Y.

One of the epidemics of cerebro-spinal meningitis referred to by Dr. Ford, occurred in Norwich, Chenango Co., N. Y., and its vicinity, during the months of February, March, April, May, and June of the present year (1888). One hundred and twelve cases were reported. In order to establish the fact that the disease was genuine epidemic cerebro-spinal meningitis, I will give a brief synopsis of the clinical histories of the cases.

Following the usual classification, there were of Meningitis Foudroyante or Fulminating, 20 cases; Meningitis Continuing, or those of longer duration, 92; Meningitis-abortive—number not recorded, and not included in the above.

MENINGITIS FOUDROYANTE.

Premonitory symptoms not uniformly present, and when so varied in duration from twelve hours to three or four days, and consisted of irregular chilly sensations, neuralgic pains, languor, loss of appetite, with furred tongue and perhaps nausea. Occasionally slight swelling of one or more joints. In the majority of cases the premonitory symptoms were not sufficiently marked to be characteristic.

The attack commenced almost invariably with vomiting, persistent and uncontrollable. Rigors or sharp chills, followed by elevation of temperature varying from 100° to 106°. Delirium or an intense apathy, violent headache, most marked at the base of the brain. Spinal pain and rigidity, and general retraction of the head, with occasional distinct opisthotonos. The cases terminated either in convulsions and paralysis, coma, or in a collapse resembling a cholera collapse, without convulsions or coma. An abundant and distinct petechial eruption existed in every instance, and in two there were large extravasations of blood into the skin.

As near as can be learned, 5 died in convulsions, 4 in coma, 7 in collapse, 1 recovered with hemiplegia, 3 not stated.

The duration was as follows: 3, six hours; 4, twelve to fifteen hours; 7, twenty-four to thirty-six hours; 2, thirty-six to forty-eight hours; 2, forty-eight to seventy-two hours; 2 not stated.

In an occasional instance, an attack would commence mildly, continue so for a short time, and then suddenly develop the fulminating character, and death result in one of the two ways mentioned. A single case may be quoted as better illustrating this type. W. M., five years old, complained during the morning of nausea and irregular chills; at 2 P.M. had a sharp chill, followed by a temperature of 105½°, vomited almost constantly, becoming wildly delirious; body was thickly dotted with petechiæ and several extravasations of blood the size of a silver dollar; at 7 P.M. was pulseless at the wrist; at 9 was seized with a severe convulsion, the convulsions continuing all night, the right side becoming paralyzed at 4 A.M., and the patient died in a comatose state at 10 A.M., just twenty-six hours from the first manifestation of the disease.

MENINGITIS CONTINUANS (2d class).

This class were more gradual in development, although occasionally commencing with violent symptoms. It was commonly thought that if a case, commencing violently, rallied from the first violence, its prospects were better than if commencing more quietly. The prodromotory stage was similar to the first variety. The attack commenced with chills, more or less pronounced, almost invariably vomiting, intense basal headache, rigidity of neck and retraction of head, an herpetic, papular, or petechial eruption. The subsequent history presented an irregular temperature curve, ranging from 100° to 103° or 105°, with frequent intervals when it become normal or subnormal, and with an equally variable pulse rate, in many instances being rapid out of all proportion to other symptoms, and at others, more particularly in the later developments, abnormally slow. Delirium was present in a proportion of the cases, although many of the milder attacks did not exhibit serious mental disturbances. Many rallied after a few days, through a slow convalescence, others gradually sank, with low delirium and many phases of mental aberration, more or less convulsive action, progressive and uncontrollable emaciation, contractured limbs, local or general paralysis, with eventual death from asthenia, or from the effects of cerebral pressure.

An analysis of the reported cases shows as follows: Vomiting—In nearly all cases, and a most uniform symptom.

Convulsions—At beginning, 15. During course, 5. At terminus, 6.

Paralysis—Local, 2. General, 3 (hemiplegia).

Retraction of head—Seventy-five per cent.

Eruption—Petechiæ, 28. Papular, 7. Herpetic, about fifty per cent., and associated with other eruptions. Absence of eruption, none noted.

Pupils and ocular disturbances—Contracted, dilated, or irregular, with frequent variations in the same case, and generally a part of each history. Unlike, 6. Double vision, noted in 6.

Disturbances of special sense — Deafness, total, 1; partial, 6 (reported).

Sequelæ—Paralysis, hemiplegia. Blindness (in one eye), 1. Deafness, total, 1; partial, 1. Abscesses, 3: parotid, 1; kidney, 1; pharyngeal, 1. Mental defects, 1 mentally "weak." Nerve lesions: 1 blind; 1 eye with retinal paralysis. Albuminuria, 2.

Whole number of deaths, 35.

Number partially recovered, 4.

Number fully recovered, 75.

ABORTIVE TYPE.

Those of the abortive type are not included in the number stated, because of the difficulty in separating them from cases of hysteria and nervous fear produced by the prevalence of the disease. Many of these were also of a neuralgic or rheumatic nature, due to the prevailing atmospheric disturbances. It is, therefore, unnecessary to refer further to this class. I think this description, which Dr. Ford will verify, will fully identify the disease. We will give under this head the following table of results:

Norwich, 72, with 23 deaths. N. Norwich, 18, with 3 deaths. Plymouth, 16, with 5 deaths. Oxford, 12, with 4 deaths. Preston, 2, with no deaths.

METEOROLOGICAL AND TELLURIC CONSIDERATIONS.

The winter of 1887 and 1888 was characterized by an unusual amount of severe weather, with heavy snow-falls and but one light thaw (last week in December) until the middle of February. January was marked by many and frequent extremes, but free from rains, and without the usual January thaw. Thus, January 2d the thermometer

was 26°; 3d, 8°; not varying much until the 10th, when it was 24°; 11th, 6°; 14th, 20°; 15th, 40°; reaching 18° and 20° on the 18th and 19th. On the 20th, 2° below, and on the 23d and 24th, 12° below; 25th, 8° below; 26th, 20° above: on the 28th and 29th, at zero. There were three severe cold waves—the 11th and 12th, 23d and 24th, and the 28th and 29th. February commenced with the thermometer at 6° above, and the early part of the month maintained cold and clear weather until the middle of the month, when there was the beginning of a "break-up." On the 9th, it was 8° below zero, with fair weather, but severe, cold, northwest winds; on the 10th, it was 10° above; 11th, 20° above; 13th, 30° above; dropping on the 15th to 9° above; 16th, 4 below, and clear and cold winds; rising on the 17th, to 30° above, with cold rain; 18th, 24°; 20th, 40°; and continuing with about the same temperature, with cold rains and a general breaking up, melting of snow, high water, and surface thawing, until the 5th of March. From the 5th until the 10th of March, the weather was warm and the thaw continued, but with less rain. On the 10th of March it grew cold, with cold northwest wind, and terminated in the blizzard of March 13th, 14th, and 15th. This in turn was followed by elevation of temperature, cold rains, and a general thaw. We again had a cold wave. On the 25th, the thermometer stood at 4°; 26th, 2°, reaching zero the same day toward evening. On the 26th, it rose to 27°; 27th, 28°; 28th, 40°, with cold rains mingled with snow. This condition continued during the first week of April, followed by pleasant weather.

From this date the weather was too irregular to classify, but there were varying rains and pleasant weather during the rest of the season.

In December, during the slight "thaw" referred to, a case occurred in Norwich, apparently of mild rheumatism, doing well, when suddenly there was a chill, followed by high fever, delirium, severe cerebral congestion, petechial eruption, and death in coma twelve hours from the beginning of the attack. Cerebro-spinal meningitis was not thought of at the time, but it the light of the latter experiences it may be considered the first "writing on the wall." On the 13th of February, at the time of the first "break-up" of 1888, a case of scarlatina was reported, which on investigation was found to have an irregular papular eruption, with a few scattered petechiæ, and disproportional cerebral symptoms, and but moderate fever. The child died in a condition of collapse in a few hours. On the 13th, also, a woman, thirty-five years old, was taken with vomiting, fever, cerebral pain, retraction of the head, and, on the second day, hemiplegia. On the

14th of February, another, a child, was seized with similar symptoms, with the addition of petechiæ, that died four months later, after a full characteristic history of spinal fever. On the 24th of February, a case of the fulminating type occurred in Plymouth, eight miles north; on the 27th, a second case of the same type occurred in the same family; on the 28th, a third and a fourth; the two latter being of the slower nature. Two others of the same family had at the same time the abortive type. On the 26th of February, another case occurred in Norwich, also of the fulminating type. On the 27th, and 28th, new cases were reported from Plymouth and from Oxford, eight miles below.

Summing up the reports, without further detail, we find the reported time of the beginning of the attacks from the various sections as follows: 1 commenced December, 1887; 3 February 13th to 15th; 46 between February 24th and March 10th; 1 March 18th; 12 between March 18th and 24th; 17 between March 28th and April 5th; 14 since April 11th. 22 not stated, except the month, as March, April, or May.

The importance of this statement lies in the question of the relationship of the time of the occurrence of the new cases to the existing atmospheric conditions.

It will be readily observed that there were successive crops of cases with intervals in which no cases occurred. These intervals were, with but slight exception, at the time of the colder and dry weather, and the new attacks invariably came on with the breaking up and the cold rains, surface thawing, high water, and elevated temperature.

The return of the lower temperature at once stopped the increase of new attacks. We draw, therefore, the following conclusion: Elevated temperature, with extreme moisture, particularly with cold rains, following prolonged cold with especially northwest winds, make an atmospheric condition favorable to the production of cerebro-spinal fever.

SANITARY CONSIDERATIONS.

The village of Norwich lies in the southern central part of New York State, in a valley about two miles wide, between high hills and practically surrounded by them. At the west side of the valley, at the foot of the hills, is a large creek, and at the foot of the eastern hills is a river of medium size. The creek referred to comes through a narrow valley and starts in the town of Plymouth, the point referred to as having cases of spinal fever coincident with the Norwich epidemic, and empties into the Chenango River at the lower end of Norwich Vil-

lage. Eight miles below Norwich, on the same river and in the same valley, is Oxford, where twelve of the reported cases occurred. Eleven miles above Norwich, on the same river and in the same valley, is located Sherburne, the location of a severe epidemic of spinal fever in the year 1860, and one referred to in Dr. Ford's paper. North Norwich lies six miles above Norwich, in the same valley. Eighteen of the reported cases were from this town, where cases also occurred in 1860.

The earlier maps of Norwich show that a branch of the creek passed through the centre of the town, and made the greater part of the village an island, which was low and swampy. At the north end the village is a bluff, with another at the west side less marked. The general character of the soil is—first, a layer of loam, varying from two to four feet deep; second, a layer of gravel and sand, shallow in the lower portions, but at the southwest bluff from twenty-five to thirty feet deep, and underneath this a layer of blue clay at a varying depth from the surface. This clay bed is impenetrable, and retains everything above it.

There is no system of sewerage, the drains and closets being made in the soil. A system of water supply exists, the reservoir being three miles from the village, and for the last three years the extra material has been washed into the soil. The general direction of the water current is from northwest toward the southeast. At the northwest end of the village was a slaughter house, and another at the northern part, as shown on the map, both in the corporation, both kept in a filthy condition and surrounded by large "hog yards." The northeast section of the village is the most thickly settled, and contains numerous stables, shops, tannery, and an abandoned basin nearly a quarter of a mile in length, that has been used for cesspool purposes for several years without cleaning. The northwest and the southeast are next in order of unsanitary conditions, while the southwest, from the fact that the clay bed is deeper, that it receives less of the general drainage, and that the fall of the land is greater, has a great advantage over the remainder of the village. The prolonged and severe winter had caused the ground to be frozen at an unusual depth, and this, associated with the natural construction of the soil, resulted in a retention of all accumulations in the cesspools, vaults, etc., in the places where deposited, instead of draining off, as in the ordinary winter season. This was made apparent when, in an attempt to improve the local sanitation, hundreds of loads of these materials were found and removed by the Board of Health.

A general inspection was made of each section of the village, dividing the town into quarter sections. In the northeast section there had been 29 cases. In 17 of the houses the sanitary condition was reported as exceptionally bad, in 5 fair, but not good, and in the remaining 7 no fault could be found. In the northwest, 11 bad, 3 fair, 4 good. Southeast, 9 bad, 2 fair, 2 good. Southwest, 3 bad, 1 fair, 2 good.

The "bad" referred to full and filthy cesspools and vaults, contamination of the water by such or other sources, and accumulations in the cellars, or in damp or water-filled cellars. In but few instances were cesspools or vaults properly trapped or ventilated.

In the northwest, was a population of 1395, with 18 cases—1 in 77. Northeast, population 1599, with 29 cases—1 in 55. Southeast, population 1204, 13 cases—1 in 92. Southwest, population 780, 4 cases—1 in 195.

But two cases occurred on the "bluffs" referred to, and those were on the southwestern. The great depth of the gravel and sand bed of the western one and its advantage in drainage, and the advantage in the drainage of the northern (which has a rocky bed with a large, or, rather, a steep water fall), seem to account for its immunity. Of the two cases referred to, one occurred March 8th; the patient was a young man who had been sent home from school because of mental exhaustion from over-study. He had suffered from severe headaches for several weeks at intervals. The second was a child that had had a tendency to brain irritation from birth. In both the susceptibility to the external causative influences, whatever they were, could easily account for the localization of the attacks without other causes.

The reports from the isolated places out of the village where cases occurred were generally "good," but in many instances the house was surrounded with the usual farm rubbish, cesspools were unventilated, the cellars unventilated, and more or less vegetable accumulation or surface water stood about the house. Our conclusions are, then, that while unsanitary conditions do not produce cerebro-spinal meningitis, they have much influence in localizing it when the proper causative condition exists.

CONTAGIOUSNESS.

The answer from the different reporters was universally "No." The only evidence that supported the theory was that in a few instances more than one case occurred in the same family. In the dif-

ferent branches of one family there were eight who had the disease during the course of the epidemic. In another four, in another five, in one Oxford family four, and in two families two each. The evidence becomes less valuable, however, when we find that these cases occurred almost simultaneously with each other, or were so far separated as not to show any relationship with each other. It demonsrates a family susceptibility, however, and is suggestive of the importance of avoiding in such instances the epidemic influence. Nurses and physicians did not contract the disease, and many cases occurred where it was certain that origin from other cases was an impossibility.

COINCIDENT DISEASES.

The vital statistics of the town of Norwich, for the year 1888, show the deaths to be as follows: Pneumonia, 1; diphtheria, 3; disease of the heart, 13; phthisis, 15; cerebro-spinal meningitis, 23; varying causes, stillbirths, 20.

Careful inquiry shows that there was no prevalence of pneumonia, either in Norwich or in any of the surrounding towns. There were eight cases of diphtheria reported during the season, with three deaths from laryngeal implication. No scarlatina reported. An epidemic of measles of a mild type commenced about the middle of June, and there were about 100 cases, with but one death.

In January there was the usual number of cases of influenza, a disease that prevails usually, at times, every year. The latter statement is made only from the recollection of physicians, inasmuch as the disease is not, as a rule, severe enough to demand special note.

THE CLIMATE OF SOUTHWESTERN TEXAS AND ITS ADVANTAGES AS A WINTER HEALTH RESORT.

By M. K. TAYLOR, M.D.,
MAJOR AND SURGEON, U S. ARMY, RETIRED.

It is not possible in the brief time allowed here to do justice to the climate of Texas as a health resort.

Its physical relations to the continent and the great seas and its climatic features are so various and peculiar as to present conditions entirely different from any other portion of this country; and we might say the remark can be extended to any portion of the civilized world.

A brief description of the magnitude of the State and its topography will give a better understanding of our subject.

Texas is situated in the axis of the continent, midway between the Atlantic and Pacific oceans, and borders on the great Gulf, which is a sea of itself. Its watershed is to the southeast and it takes its winds from the ocean three-fourths of the year, and for the other fourth from the arctic regions.

Most of us judge of the size of other States by comparing them with those nearest our homes, of which we know the most; and it is for this reason that those who have never examined into the matter, rarely have a just conception of the wide extent of that State.

If we measure it by the lines of travel, and commence at the southeastern angle on the Louisiana border and follow thence the course of the Southern Pacific railway to El Paso, we find the distance to be 963 miles, or several miles farther than from Washington to St. Louis; and measuring the opposite angles from Fort Brown at its southwestern extremity to its northeastern at Texarkana, 700 miles. From its extreme eastern to its extreme western limits on the parallel of El Paso, the distance is about 675 miles.

Its area equals that of all the other Gulf States and the half of Tennessee.

The general surface of the country is but little broken, save by the water-courses and moderately rolling prairies until we approach the northwestern region, where there are high table-lands and occasional

terraces and upheavals reaching heights varying from 5000 to 7000 feet above the sea.

The eastern portion is heavily timbered, and there is some timber along the coast, but as a rule, excepting the river bottom-lands, it is not heavy. In the central portions there are sparsely timbered districts of post oak, and in the southwestern district and on table lands east of the Chinati and Guadalupe mountains, the mesquite constitutes the principal timber growth, though there are some live oak and post oak groves suitable for fuel on the highlands, and excellent pecan and cottonwood forests along the streams. With the exception of its eastern portion it is in no sense a timbered country. Most of the mesquite has grown up in the past thirty years, since, in fact, the country has been reclaimed from the native Indians, and the annual burning of the prairies stopped. With the growth of the mesquite there appears to have been a decided increase in the annual rainfall of the central portions of the State. The observations at the Blind Asylum at Austin, for a series of years, indicate that this increase has been from about 29.5 to 35.75 inches; a sufficient amount for all agricultural purposes. In the southwest along the Rio Grande valley the precipitation is from 20 to 25 inches, while at El Paso it is about 13 inches, subject, however, to great variations; in some years the rainfall has been less than 5 inches. At Galveston the precipitation averages 52.3 inches, but this diminishes as we go southward and westward, so that at Indianola and Corpus Christi it amounts to 38.7 inches, and at Fort Brown it is only three-fifths of that at Galveston, although 175 miles further west and 350 miles further south, or within a degree and a half of the Tropic.

The extremes of rainfall for the State may be stated for Galveston at near 60 inches or about 5 feet, and at El Paso, 4¾ inches.

The effects of these differences in precipitation are seen exemplified in the abundant forests of the eastern portions of the State and the absolute barrenness at El Paso, where only by irrigation does any vegetation grow, save a few stunted cacti on the hill sides and barren mesa.

Intermediate—that is, through the midland districts, where the elevation does not exceed 1000 or 1500 feet—the precipitation is abundant for all agricultural purposes, and the whole country is fruitful and prosperous. Along the valley of the Rio Grande the country is adapted to grazing chiefly. In some of the valleys where irrigation has been instituted good crops are obtained, and with certain kinds, like garden vegetables and the grasses, two and three harvests are obtained during the year. In other words, cultivation is continuous.

As may be expected, the difference in precipitation indicates, in a measure, the difference in the degree of saturation of the atmosphere, or relative humidity, but there are several important exceptions, as the following table will show.

Table showing the relative humidity at some of the more important stations, compared with the rainfall.

Place.	Annual precipitation.	Relative humidity or per cent. of saturation.
Fort Brown	33.01 inches.	78
Indianola	38.72 "	78
Galveston	52.30 "	76
Palestine	47.56 "	71
Denison	41.44 "	68
Clarksville	39.85 "	70
San Antonio	32.31 "	68
Fort Concho	30.99 "	64
Fort Clark	29.12 "	64
Fort Griffin	24.57 "	59
Fort McKavett	23.58 "	62
Fort Ringgold	22.52 "	68
Fort Davis	20.38 "	53
Fort Stockton	20.09 "	55
El Paso	13.14 "	48

It will also be observed that commencing at Galveston and going northwestward and southwestward, there is a gradually decreasing precipitation until we reach El Paso in the north, which has one of the dryest atmospheres in the Union; Fort Yuma and Fort Grant, Arizona; Winnemuca, Nevada, and Salt Lake City having a small per cent. less.

But it will be further noticed that away from the coast the air is relatively dry, notwithstanding there is a medium rainfall all through the central portions of the State, so that in so far as the human constitution is likely to be affected in the transpiration and evaporation of the excretory fluids, there are all the physical conditions present to facilitate these processes to any extent necessary to promote healthy action. The reason for this is that when it rains the precipitation is abundant and of short duration as a rule, after which the usual moderately dry winds prevail and clear the air.

But more than this. The condition of the atmosphere is such in the western portions that many substances which in more humid regions readily undergo putrefactive decomposition become desiccated

and innocuous, and it is quite certain that in our surgical experience many operative measures are more successful there because of this dryness than they appear to be in other localities where the humidity is greater. We know very well that a damp and warm atmosphere promotes zymotic action, and that all forms of contagious elements and cryptogamic life are abundantly more active in these conditions than when the atmosphere is relatively dry. Does any one suppose for an instant that the mummified bodies of the crypts of the temples of Egypt would have remained for centuries in their present condition, had not the atmosphere in the country been too dry to permit the usual organic decomposition to go on? Yet Texas has, in some portions, as dry a climate as that of the Nile region, and where, if people object to being buried or cremated, they can have their earthly elements embalmed after the ancient methods and stored away in the caves to remain as lasting mementoes of this enterprising age for centuries to come.

The coast is humid as is always the case near the sea, but in this it has as favorable conditions as San Diego, or the coast cities of Florida. Parkes says that the degree of saturation most agreeable to the majority of persons is found to be between 70 and 80 per cent., and it is rare indeed, except during storms, that the saturation on the Gulf coast exceeds 80. The average is from 76 to 78 per cent.

Away from the Gulf, however, at the distance of one or two hundred miles the air loses its relative high saturation and becomes moderately dry without any precipitation taking place intermediately. It is a singular fact that at San Antonio the winds are the trades from the Gulf, coming, however, from the south and southeast, and one would naturally expect them to be laden with moisture, inasmuch as there are no intervening elevations to cause precipitation between the coast and the city, yet the atmosphere is saturated only to the extent of 68 per cent., while at Indianola, the point from which the winds come directly, it is 79. The difference in temperature does not explain the difference in saturation. Most of the winds in the northwestern part of the State, excepting in the region of El Paso, come from the direction of the Gulf coast, also, but we see how little rain is annually precipitated and what a low degree of saturation prevails at Forts Stockton and Davis, though there have been no extraordinary precipitations between them and the sea.

I enter upon the subject of the temperature of that State with a feeling of diffidence. So much has been said in relation to it, that I fear what I may offer may be received with doubt and a great many

grains of allowance. In the belief that all Southern countries are hot, and from the representations that have gone out that Texas heads the list, most people are incredulous of anything that may be said to indicate that the contrary climatic condition exists; or, if there be a disposition to give credit to the people from that State for an honest desire to tell the truth in respect to its climate, it is nearly always with the mental reservation that they have become so accustomed to being roasted that they do not mind it. Much of this feeling has come from the "extravagant stories which have been told for the delectation of the gullible" of which the following may be considered fair samples.

It has been said that the late Lieutenant-General once remarked that if he had to take his choice between the place the name of which ends with two l's—or Texas, he would take the former; though he has denied the paternity of any such statement. And another story has been going the rounds of Army circles to the effect that a soldier died at Ringgold Barracks on a certain time and went where most soldiers are supposed to go; but on the third day his ghost returned and asked for his winter overcoat, his new abode being so much cooler. To state it somewhat extravagantly, in a popular sense, that country is little better than a vestibule to sheol. And, again, that in the early settlement of the territory, and which custom still continues to some extent, in their belief, people with a guilty conscience and whose moral turpitude led them to believe that in some future state they would be likely to have a tropical climate for a residence, went to Texas as a preliminary acclimatory process.

We may be pardoned, we trust, for stopping here and saying that all such representations are not true.

The climate of Central and more especially Southwestern Texas, away from the Gulf coast and valley of the Rio Grande, is delightful. Three-fourths of the year it is unsurpassed by any country in all that contributes to the health, comfort, or pleasure of its inhabitants, and only because of the length of its summers can it be considered objectionable in any sense.

The extreme temperatures are not as high here as in the northwest, or in the interior regions away from the seaboard and the great lakes. At Omaha the past season the temperature ranged from 104° to 108° F., with extremely hot nights, while at San Antonio, at the same time, the thermometer recorded 94° and the nights were cool enough to require light coverings.

No less mistakes are made in respect to its winter season. The

popular notion is to the effect that the Texas northers are something terrible; that they come down unheralded and freeze people to the very marrow of their bones as stiff as an icicle; and it cannot be truthfully denied that they are a little cool sometimes. We say Texas northers, however, in the popular use of the expression, but Texas has about as much to do with them as its summer temperatures have to do with fitting sinners for the fervid realms of another sphere.

The northers are not of Texas origin; are not unheralded, they always give due notice of their approach; they are not a curse, but, on the contrary, one of the greatest blessings that Providence in all its bounties can bestow on any land. They are moderately cool, dry, stimulating, highly electrical, and healthful. They are but the thinning out of the cold waves or blizzards of the North, which come down overwhelmingly upon the northwestern States with such disastrous results, and they hold to their northern cognomen until the northwestern boundary of Texas is reached, when they have their names changed. Fortunately for the people of the State, they have their temperatures changed at the same time and their fierceness subdued. The temperature rarely goes to zero, only in the region of El Paso and the Staked Plains, while in the central and southwestern portions of the State it is rare indeed that the thermometer records a fall below 20°, or 12° below freezing, a temperature which in the north is regarded as very moderate and healthful.

But between the "blizzard" of the North and the "northers" of the South there is a great difference as to the ultimate ending of the meteors. In the North they are generally followed by days and weeks of extremely low ranges, while in Texas, if the cool spell lasts more than three or four days or at most a week, it is considered remarkable. As a rule, the temperature rises above 32° on the third or fourth day, when the air is exhilarating and the activity of every function of the body increased. What has led to such unfavorable comments on these phenomena is, that the change is so sudden from warm summer temperatures to those of freezing in a few hours or a day. But these warm unseasonable waves in the autumn and winter are forerunners of the change, and may be relied upon with reasonable certainty as due notice that a cold wave is coming from the north.

If the people would heed these warnings, nine-tenths of the discomfort chargeable against the northers could be avoided and nearly all the risks duly provided for. But it is easier to grumble about them than to go to the trouble of getting ready for their arrival.

In no part of the United States are similar atmospheric perturbations less harmful, or more salutary.

A recent writer in one of the leading great works on medicine says of the climate of southwestern Texas, "that it is one of extremes, and should be avoided except in special cases." It is evident that he had never spent a winter there and was very ignorant of its charming winter seasons. This, indeed, must be true, otherwise in mentioning prominent health resorts in this country he would not have utterly ignored San Antonio, one of the most deserving and popular in the United States. To indicate how groundless are such statements we have but to mention the fact that the Signal Service reports show that for a series of years the average number of days during any portion of which the thermometer goes below the freezing point at San Antonio is 14; or in other words, that we have freezing nights about two weeks only during the three winter months. As a rule, we have no frosts before the middle of November and no cold winter weather worthy of being so called until about the first of January. One year with another, roses are in bloom until Christmas, the rosebushes and honeysuckles hold their green leaves until spring and more frequently bloom every month of the season unprotected in the open air, while the huisatche, the peach trees, and the primroses commence to bloom in February and therefrom spring opens. Is such a climate as this to be classed as extreme? The remark, therefore, is hardly justified that "San Antonio is a Texas town, and Texas with its ill-famed 'northers' is that part of the United States which is the most liable to great and sudden falls of temperature upon the supervention in winter of a northern wind."

The appended tables will indicate the truth in regard to the temperature, and the graphic chart conveys to the eye at a glance a comparative representation of the climates of the more prominent winter resorts in the United States. It shows the maximum, minimum, and mean temperatures and the mean dew point. As it is drawn to an exact scale, the longitudinal lines representing degrees, calculations and comparisons can be made with the same certainty as from recorded tabular statements.

Much has been said about the relation of the daily range of temperature to the dew point. These tables show that clearly. It will also be seen by reference to the chart for the Gulf coast stations, the Pacific stations, and those of the interior of the State, where the monthly averages are given for a series of years. A difference in a dry, warm climate of 25° is very agreeable, and especially so in the

warmer seasons, thereby giving cool, delightful nights; and still better, if the climate be so dry that the nightly fall in temperature does not reach the point of saturation, as seen in the deposition of dew.

The difference between the mean dew point and the temperature at El Paso is 23.8°, at Fort Davis 17.5°, Fort Stockton 12.2°, San Antonio 10.7°, Fort Concho 9.8°, Fort Ringgold 9.6, Galveston 7.3°, Indianola and Corpus Christi 6.1°, and at Fort Brown 4.5°. These comparisons are made from observations taken at 11 P. M., and the appended table shows the differences for every month. This table differs from the chart in respect to the mean differences between the *average* temperatures and the dew point for the whole day, in that, this table has reference solely to the night observation at 11 o'clock, Washington time, and its value consists in showing the relative dryness of the evening air. For the three winter months at San Antonio the difference between the mean minimum temperature and the dew point at 11 P.M. is 13.2°, a condition certainly quite dry enough to meet the ideas of any reasonably exacting dry air advocates, and it indicates that in nine-tenths of this season of the year feeble persons may go about with few or no wrappings at that hour. There is rarely that sense of dampness which is common to high altitudes near the cloud line, or on the seacoast, experienced in that city.

The winds play an important part in making an estimate of the adaptability of the climate of any resort to the needs of invalids. They contribute to the comfort or discomfort of this class of people according to their velocity and the direction whence they come in the different seasons of the year. A harsh wind in the winter is unbearable for the sick, but a tolerably stiff breeze in the summer season is a delight to most people.

Now there is a somewhat singular phase of this subject presented by the atmospheric movements in Texas. At Indianola and Corpus Christi, on the northwest coast of the Gulf, the velocity of the wind for the year averages 12.9 miles per hour; at San Antonio, 100 miles northwest, 4.5 miles; at Fort Stockton, 250 miles farther northwest, it is 9.6; while at El Paso, 300 miles still farther, the velocity is the same as at San Antonio, but with this difference in the direction, that the winds at the former place are mainly from the south and southeast, while at the latter they are from the north and northwest. At San Antonio the currents come from the southeast and northwest in about an equal degree during the winter season.

In order, perhaps, to get a better understanding of the wind movements, it will be well to give the velocities of other localities.

The rate at Indianola is excessive, there being but eight signal stations where the average annual velocities exceed that rate—*i. e.*, 12.9 miles. These are Pike's Peak, Mount Washington, Cape Mendocino, and some of the stormy capes of the Atlantic; but as they come from the Gulf, except during the short periods of the northers, they are not cold though quite damp. At San Antonio the velocity, as has been stated, is only 4.5 miles, than which there are but eight stations having less. When compared with Jacksonville, where the average is 6.6, and at Denver 6.4, and San Diego 6, we see that the winds at San Antonio are of the gentlest character, and excepting storms, only such as all persons and places need for comfort and health. As for the prevalence of storms, they are less in number and intensity by far than is witnessed in the Northern States, and it may be stated in proof that in twenty-five years in that city but two storms have occurred of a character to do any damage worth mentioning. Lightning and thunder are not a moiety of what is yearly witnessed in the latitude of the lakes and the northwestern States.

I will close this part of our subject by a brief summary of the climatic conditions of that southwestern country.

One extreme is seen at El Paso, where the elevation above the sea is 3950 feet, and where the temperature is subject to great daily and yearly variations, an exceedingly dry air, a nearly cloudless sky, and where the northers strike with considerable force. Out of the sun's direct rays, in the summer the climate is tolerably cool and delightful, while during the winter, excepting during the prevalence of the northers and sand storms, the climate, owing to the thermancy of its atmosphere, is genial, and one could hardly find a more agreeable and bracing air in the day-time; but the nights are so cool as to require considerable outer covering if one would be out of doors. The mean maximum temperature is 57° and the minimum 30°, and the relative humidity 48 per cent., or 1 per cent. less than Denver.

The Gulf coast is the opposite of El Paso, and bears a close relation to the coast stations in Florida and southern California. The climate is essentially humid, more windy, but not harsh; and with temperatures of 70° at Indianola and Galveston, and a saturation at the former of 78 and at the latter of 76 per cent. and an average cloudiness of 4.2.

San Antonio holds a medium position in all these climatic elements. The mean maximum temperature for January is 62° and its minimum 42°, with a yearly relative humidity of 68 per cent., or about the lowest degree stated by Parkes as most conducive to health. Its

cloudiness averages 4.6, its altitude is 700 feet, the surrounding country rolling, well drained, and healthful.

The number of clear and fair days at El Paso averages 330, on the coast 275, and at San Antonio 287.

As a health resort, the southwestern portion of the State is the most noted, and of this, San Antonio is the principal city and the only place, away from the Rio Grande and Gulf stations, where systematic meteorological observations have been kept up for a series of years. Stations were maintained for short periods at Boerne, 30 miles northwest, and at Castroville, 35 miles west of San Antonio, but they have been abandoned for some years, so that for the present the observations at San Antonio are the only reliable data available away from the Rio Grande. Its central position is such, however, and the general features of the surrounding country so nearly in common in respect to soil, drainage, rainfall, winds, and temperature, that the statistics of its climate are fairly expressive of a large area of territory.

It may be proper here to say a few words in regard to the nights, and in doing so I feel quite safe in stating that it will be difficult to find another place on the continent where the hours of sleep and repose can be enjoyed the year through in a greater degree than in this section. The cool, dry breezes enable one to sleep in the draught without risks, as nearly everybody does, and the evenings, with their clear skies after sundown, and beautiful moonlights, and the cool morning winds up to 9 or 10 o'clock, are something that persons must see and feel for themselves to appreciate thoroughly. Not a night for the past summer has there been in the city that sultry condition so oppressive to every one during the warm season in the North. The fresh morning air at a temperature of 68° to 75° is a delight.

And the question now arises, What are the practical benefits to be derived from the climate of southwestern Texas? The answer is, There are many. Chronic catarrhal affections, except perhaps of the nasal regions, which are occasionally seemingly irritated by the dryness, and the earlier stages of tuberculosis are almost invariably benefited if the patients remain long enough for the climate to do any good; chronic rheumatism and disease of the kidneys, both of which require a long time to effect a permanent benefit, and some nervous affections in which outdoor exercise is an essential feature in the treatment; these we say may go to San Antonio and the southwest country with the assurance that their ailments will be alleviated or cured by a prolonged residence. In making recommendations for a change of climate, however, it is not necessary to draw the fine lines of diag-

nosis which some authorities recommend. We have no mathematical rule for measuring diseases, nor have scientific methods become so exact as to specify the particular origin in a given case and its remedy. It is folly, however, to have patients go to that country expecting a radical cure by a stay of a few weeks. Radical changes are effected slowly in these lingering cases. They exemplify the truthfulness of the eminent Trousseau's remark "that chronic cases of disease require chronic treatment."

On the other hand, if they go there for the purpose of avoiding a rigorous and dangerous season at home, hoping to find enjoyment and recreation for the time being, and with the purpose of returning northward with the approach of the milder seasons there, then everybody may go and be benefited.

Nor would I exclude those in the second stage of consumption. They are frequently improved greatly by a winter residence in that country, but it is useless to send those in the third stage with the expectation of ultimate recovery other than in the exceptional cases of what may be called acquired tuberculosis, and when the tubercular infiltration has not invaded the whole pulmonary structures.

As a pleasure resort simply, and where one desires to engage in outdoor sports, San Antonio holds a central position, and one which enables visitors to reach the Gulf within a few hours' ride by rail, where the fishing and waterfowl hunting can be enjoyed to the heart's content, or if bolder and larger game be the object, the mountains, thirty or forty miles away to the northwest, also within easy access by rail, afford every opportunity for that kind of enjoyment. Ladies will find every facility for outdoor exercise on horseback, or in driving, that they can wish for the largest gratification of their desires, while young children can be taken into the open air four-fifths of the winter season.

The opinions which have been presented are the result of a pretty large experience in the various sections of the United States. Born, raised, and educated in the North, and with professional and personal experiences on the ocean and Gulf seaboards and some experience in climbing the Colorado mountains, I think that I speak advisedly, when I say, of them all I prefer that southwestern country where the most comfort can be had for the least trouble and expense; where the social relations are excellent, business is thriving; and for those who wish to take their families with them and have their children continue to pursue their studies, the schools of San Antonio afford excellent advantages. For delicate children who require the invigo-

rating influences of moderately cool weather and active outdoor life, that climate is all one could wish during the winter season, while the spring, with its multitude of flowers, its fragrant breezes, its genial sunlight, and its evenings with their soft, sweet repose, give one a better idea of an earthly paradise than any place we have ever seen, or hope to see, in this broad land.

THE ENGADINE AND DAVOS.

By D. B. St. JOHN ROOSA, M.D., LL.D.,
OF NEW YORK.

During the last summer I have had an opportunity of revisiting the famous Engadine Valley, and also to see for the first time Davos and Wiesen. As this Society well knows, much has been written, both in England and in this country, upon these high health resorts, especially as to the fitness of an abode in them by consumptives during the winter. On the question as to whether places of great altitude are suitable and recuperative for phthisical subjects, I shall have nothing to say, for I have no especial experience that fits me for any expression of opinion upon this point. All I shall attempt to do is to make some remarks, founded upon observation, as to what may be actually found in the way of air, food and drink, living accommodations, and so forth, by those who are sent to the Engadine and the contiguous regions in summer or winter. Such remarks may possibly be of some service to those physicians who, while well acquainted with the claims made for great altitudes and so-called aseptic air for their patients, do not know by actual visitation what is to be found in the details of living.

A journey across the Atlantic is only the beginning of the long journey to the Engadine or Davos. Yet many Americans, if they become invalided, for various reasons prefer to go to Europe than to Colorado or California. One reason for this is to be found in the fact that they believe that, after the tedious journey is over, the older civilization will make them more comfortable in such matters as a bed and room, places to walk and sit, and food, than will the younger one in our own country. It seems to be a fact that European hotel-keepers are more eager to meet and less impatient to fill the little wants of invalids, or even of ordinary travellers, than are the same class in America; hence, European hotels are generally more comfortable than those of America. I am often surprised at the hap-hazard way in which invalids are sent across the ocean, and at the very inadequate

preparations that are made by them, and by delicate persons generally, for the passage. There is really no place where more care is needed to secure proper food and to wear proper clothing than upon the ocean. A voyage across the Atlantic is not of necessity a health-giving process. To nervous, jaded people, overladen by cares at home, it generally is; but a person with a cough, or one who is inclined to be constipated, or a dyspeptic, may pass off the steamer, unless great care be taken, worse than when he went upon it. In the summer-time steamers are now so crowded that the opportunities for fresh air even on deck have become limited, while for exercise there is on many vessels none at all. In the autumn or winter these conditions are improved, but then the passages are rough. In spite of the landsman's tradition, that one never takes cold at sea, it is an uncommonly good place for an attack of coryza, tonsillitis, and bronchitis. Invalids starting for a foreign health resort need as careful advice for the steamer journey as for their abode at their destination. They who get it from the surgeon of the vessel are few. One reason is, that they scarcely ever ask for it, and another, that the medical officers are not always men of experience enough to advise the passengers properly. An invalid or delicate person at sea should have the daily care of the surgeon, who ought to see that such passengers are fed with system and care. No happy-go-lucky belief that all will go well if they simply breathe the salt air should be encouraged. I know of but few more oppressive places than state-rooms in which the ports are not very often opened, and the overcrowded cabins of large steamers.

Once on the coast of Germany, Holland, Belgium, or France, in Bremen, Rotterdam, Antwerp, or Havre, the invalid will have a long railway journey before him, which should certainly be broken, for only under exceptional circumstances or at great expense, such as is incurred by hiring a *coupé lit* or berth in the few Pullman cars, can accommodations equal to those easily obtained in the United States be found. I refer chiefly to the absence of cabinet and lavatory arrangements in the railway carriages. It is only rarely that they are seen. Their absence is a great evil even for well persons, who can jump from a train when it stops five minutes, and run an eighth of a mile to empty their bladders; but what is this abominable system to delicate men and women and those travelling with young children? I have seen a lady, at last forced to it by the long journey without an adequate halt, much to her mortification, hold her little boy up to the window and allow him to urinate in sight of the crowded *coupé*. Many more distressing scenes than this constantly occur. The danger of murder

in the English and French railway carriages, is one that experience shows is not entirely wanting, and yet the British and Continental railway authorities move very slowly in the reform of their carriages.

If the Engadine be approached from the Swiss side, it will probably be from Chur (Coire), about twenty-six to thirty hours from the coast. Here good carriages may always be obtained. But the trip, which is one continual ascent, should not be made in one day, although the longest route to the Engadine is only from fifty to sixty miles. The average American wit and caution should be used in selecting a driver and a carriage. The sleeping accommodations, even in very humble and remote places, in Switzerland are exceedingly good. A clean and soft bed, and nutritious food, generally well cooked, are almost always to be obtained. The routes from Coire to the Engadine or Davos are no exception to this. I will not break the continuity of my paper by asking if these things are to be found, as a rule, outside the great cities, in our own country.

The Engadine, with its history and the character of its inhabitants, has much to interest us aside from its fame as a health resort. The Germans were the first to utilize the valley as a a curative place for consumptives, although the question of the suitableness of high altitudes for them is by no means a new one. Dr. Tucker Wise[1] shows that here also the practical wisdom of our time was foreshadowed by the older writers. Dr. Bodington, of Warwickshire, forty-five years ago, said: "To live in and breathe freely the open air, without being deterred by the wind or weather, is one important and essential remedy in arresting the progress of phthisis. . . . The cooler the air which passes into the patient's lungs, the greater will be the benefit which the patient will derive." Dr. Bodington called cold, pure air a sedative to the lungs. I suppose the writers of the present day are a little more specific when they claim that it is *aseptic*, or that it has germ-destroying qualities.

The Engadine Valley, as is well known, is a small one—about sixty miles long and about a mile wide. There is scarcely any agriculture. The Alpine grass is all that can be cultivated. The larch and the pine grow upon the lower parts of the mountain. The clearness and apparent purity of the atmosphere in summer would strike even a careless observer. It is a joy to exercise in it. But the Engadine is usually cool and often cold even in July, and very cold in winter. To use an old quotation of mine from a witty French woman, whom I

[1] Alpine Winter in its Medical Aspects.

saw at St. Moritz two years ago, "You can walk in the Engadine, but you cannot sit down." The various places in which invalids congregate in this region—St. Moritz, the Maloya, Samaden, Pontresina, and Davos and Wiesen, on the other side of the valley—are well provided with the facilities for sitting down by the wayside, as they are with many other conveniences for invalids. To this there is one exception in the summer-time, at least; I found but in one place, and that the Hotel Maloya, anything adequate for keeping one's self comfortably warm in the house. The guests of the hotels went about with overcoats, and even men sometimes dined at the *table d'hôte* with shawls over their shoulders. Since St. Moritz is more than six thousand feet above the sea, and Davos nearly five thousand, there must be many cold days in summer, even when the sun is usually fully out. In summers like those of 1886 and 1888 no invalid—indeed, no person of average health—could be comfortable in the reading-rooms or drawing-rooms of the hotels for much of the time unless they were wrapped in furs. To secure a fire in one's bedroom, except in two of the hotels in St. Moritz Baths, was not difficult. The rooms are heated by iron stoves, constructed on the vicious principle of radiating sufficient heat about an hour or so after they are heated by a small wood fire. This works fairly well in porcelain stoves, such as are used in North Germany, but I have never seen it do very well in those immense iron cylinders in vogue in other parts of Continental Europe. One hotel in Davos has a few open fires, and I saw an American coal-stove in a dining-room of another hotel in the same place. The hotel proprietors in Europe, as in America, are very reluctant to admit that a public room needs a fire in the summer, although they are often the losers, in consequence of their unwillingness to keep them warm, in the short residence and early departure of their guests. Inasmuch as invalids cannot always be in the open air or go to bed directly they are indoors, this failure to keep a comfortable temperature is very trying. In the hotel at Maloya there is a system of heating that I found very pleasant in the three days I was there in August. One of these days there was a snow-storm. The outside air is warmed by passing over steam-pipes, and then by a system of registers is let on or shut off in the various rooms.

It is not, however, in the summer that the question of life in the Engadine or Davos is of the most importance. Although many invalids stay there all the year round, they are chiefly important as health resorts in the winter. The Engadine, however, is crowded with wealthy and fashionable people in the summer. It is the *mode* to go

there to stay a few weeks, especially among the English and the Anglo-maniacs. The former are so accustomed to fog, rain, and cold that I do not wonder, with their aptitude for walking, that they put the clear sky of this region and its invigorating air high up in the scale of pleasure as well as health resorts. The waters of St. Moritz have no very great therapeutic value, I fancy. They are predominantly iron, apparently not so much impregnated as many others in Europe and our own country. Pontresina has no waters and few attractions, except to Alpine climbers and hale pedestrians, and yet it is so crowded in summer by many people who cannot be said to belong to either class, that rooms are not easily obtained unless by writing long in advance. The village is small, its streets narrow, and they are redolent with the very prevalent Swiss odor in small villages, that of manure. The hotels, except one, are badly situated. Yet a good deal of what the French and Italians are so fond of calling English and American *high life* fills Pontresina. Although there are two glaciers and no end of Alpine meadow at Pontresina, it is hard to conceive how the Maloya, with its free expanse of unoccupied territory and its excellent and well-situated hotel, remains half filled, and even then with some impatient people waiting for poor rooms in the gorge-like streets of little Pontresina.

Some people find all ascents, even going up-stairs, noticeably more difficult in the Engadine than in ordinarily situated places. Usually, only the extreme clearness and purity of the atmosphere are perceived, even on first arriving. It should always be remembered that life in the Engadine is about 6000 feet above the sea, and that not every invalid or even healthy person can tolerate it. An old American gentleman died at one of the hotels, just before I arrived, of cerebral hemorrhage. His physician told me that he thought that death had been precipitated by his visit to such a region. It is certainly manifestly unfit for persons of full habit and with very weak hearts or weak bloodvessels. Certainly patients should not be sent off to the Engadine by physicians without some consideration.

Davos, so famous in our time, is situated in what Bädeker calls a *district* of that name in the same canton with the Engadine Valley, and was until within a few years so isolated that the guides used to speak of it as a place in which no foreign foot ever trod. The inhabitants generally state that no one born in Davos ever had consumption, but, of course, it is impossible to verify such a statement as this. The district is also a high valley, but only eight miles long and half a mile broad. It is remarkably well sheltered by high mountains,

and must be freer from wind than the Engadine. The growth of small pines is profuse and beautiful. It is a thousand feet or so lower than St. Moritz or the Maloya. It is a charming region, the air being apparently as clear and as aseptic as that of its higher neighbor. Davos place and Davos village are about a mile from each other theoretically. They almost connect, however, and the two places are rather thickly populated if, as I was told, there are two thousand invalids there in winter, besides their attendants and the inhabitants of the very small villages around which the hotels have been built. At St. Moritz village there are about two hundred invalids at the most in the hotels, and at Maloya fifty, in one. The baths at St. Moritz, a mile from the village, are closed in summer. It is evident that the large population in Davos may become a source of danger, as in Pontresina in summer. Yet I have a belief that the watchful English man, to whom we are indebted for the great improvements in water-closets and urinals throughout the continent of Europe, will see to it that the sewage does not contaminate the water, and that the closets are flushed. There is much reckless behavior by Americans, sick and well, in many of their habits, and some of it consists in their drinking water in all kinds of places, with no inquiry as to its source or liability to contamination.

Teetotal principles are at the bottom of some of this lack of wisdom. To those who have conscientious scruples against wine, tea and coffee and natural mineral waters furnish a resource. There are about a dozen hotels in Davos *Platz*, and two or three in Davos village, all in the space of about two miles in length and half a mile in width. The closets of the various hotels are generally of an improved variety, and are kept in order. The water-supply is apparently not contaminated. The milk furnished at Davos is of excellent quality. Watery milk and a queer-tasting white fluid sold for milk, are not uncommon in British and Continental Europe. On the Isle of Wight, especially at Ventnor, where is the hospital for consumptives, at Davos, at Maloya, milk may readily be had as good as that of the Echo Farm and other famous places in America. The food furnished at the *table d'hôte* breakfasts and dinners in many of the hotels is not nourishing enough, although the courses are sufficiently numerous, for an invalid or delicate person, and I would advise such persons to see to it that they have an honest beefsteak or a large slice of beef or mutton in addition to the thin soup, the inch of dry beef or veal, and half a leg of chicken that go so far to make up a Swiss *table d'hôte* dinner. This can always be had by paying a very little extra, or by dining or lunching by

one's self *à la carte.* Board is not high in Davos. I have before me a *tarif* of one of the hotels frequented chiefly by English and Americans. A room and board, breakfast (coffee and rolls), dinner, and supper may be had at from six to twelve francs a day, according to the location of the rooms. Milk and wine are extra. The latter is also good and cheap. There are donkeys and bath chairs, and horses and carriages at reasonable rates, and no end of tobogganing in winter. Indeed, all the active invalids are said to spend their waking hours, except when eating, in the latter employment. One end of the town is devoted to the Anglo-Saxon, since only English and Americans live there, while in the other live those whom the Briton, no matter in what country he may happen to be domiciled, speaks of as foreigners. They are Swiss, German, Dutch, and French, with now and then a brave American who speaks one language besides his mother tongue, and who does not like the English to the exclusion of all others.

Wiesen, twelve miles below Davos, should have at least a word in an article on the high health resorts of Switzerland. It is hardly a village, but it has two pleasant hotels situated beautifully on the sunny south slope of a very high mountain. The place itself is more than 4500 feet above the sea. Like Davos, it is well sheltered from the winds. Beneath it is a beautiful and rapid stream of water. It is recommended by Dr. Wise, of Maloya, as an excellent stopping-place for those leaving the higher lands in the spring. It has, however, intrinsic qualities in beauty of situation that make it apparently very desirable for a consumptive's winter or summer abode.

There are many other things observed, even by one who cannot lay any claim to give expert testimony on high health resorts for consumptives, that might be narrated, but perhaps what I have been kindly allowed to say to you may supplement more recondite experiences, and turn the attention of the members to a study for themselves of the authorities who treat more exhaustively of the effects of high altitudes upon diseases of the chest. It ought also to be noted that pernicious malarial infection, or chronic malaria, would without doubt find a cure in the Engadine or Davos. But this may be obtained much nearer home, in many of the counties of New York State, such as Sullivan, Delaware, and Otsego. I met a young American physician at Samaden suffering from the effects of Chagres fever, who had been advised to go to Davos, and I afterward saw him at the latter place, much improved in a few days. He assured me that the profession at home would still welcome notes on these regions.

In visiting these places, a very natural inquiry occurs to every professional mind: Do patients actually recover from tuberculosis by living in them? Certainly a summer visitor cannot answer such a question, and perhaps no one but a resident physician of a judicial and conservative temperament can ever do so, and he only by a ripe experience and careful record of his cases. But, on superficial observation, this much seems to be shown: life is made much more comfortable and is prolonged to many by an abode in these high altitudes. A few are cured of something, and become well enough to go home and live out their days. A frail, coughing young lady, with a hectic flush, said to me: "I have lived here three years; I am no better, but I am no worse, and I am happy." In Davos, St. Moritz, and the Maloya the invalids and their friends form a happy family. Even a young man without acquaintances soon becomes at home and shares in the common interests. Everything centres about the invalid; all is done to prolong and save his life. The tone of the little society is a cheerful one. Not many deaths occur, since advanced cases rarely go to the Engadine or Davos. Altogether the exile, although an exile, is a happy one, so sweet is life and the hope of life to the human heart.

THE VALUE OF MINERAL WATERS IN THE TREATMENT OF URINARY AND ARTHRITIC DISEASES.

By ANDREW H. SMITH, M.D.,
OF NEW YORK.

In the brief time which this discussion allows to each one taking part in it, I cannot do more than to indicate the general principles which, as it seems to me, should govern our selection of mineral waters in the treatment of the diseases under consideration. For convenience in doing this, the two classes of disease will be treated of separately in relation to the waters to be employed.

While it is not uncommon to find the waters of various mineral springs highly recommended for the treatment of renal affections by physicians residing in the locality, there is but little in general medical literature to indicate that these waters have a fixed place in the esteem of the profession as agents in the treatment of this class of diseases.

In fact, the intelligent discussion of this subject requires that we should consider, very briefly, the general question of the treatment of renal inflammation.

I think that there will be little or no dissent from the proposition that, so far as the kidneys themselves are concerned, the dominant indication is to obtain the greatest possible degree of physiological rest. But here comes up a question of definition: What is the physiological labor of the kidney, cessation from which constitutes physiological rest? To answer this we must analyze the apparent function of the organ and determine what in it is active and what is passive. Blood is carried to the kidney, and from this blood is separated water containing certain substances in solution. These substances are partly organic, partly inorganic. The anatomy of the kidney is such as to suggest that probably the separation of the urine from the blood is partly by simple transudation, partly by the specific action of the epithelial cells. It is also probable that the water is chiefly transuded through the capillary walls, while the solid material, for the most part,

is, at one period, held in the interior of the cells, having been the subject of their specific selective action, and that it gains access to the tubules only by the rupture of the cell wall.

Now this last is alone entitled to be considered the function of the kidney, regarding the word function as indicating an action peculiar to a given organ, and for which it is specially constructed. In this action an expenditure of vital energy is essential. For its performance a due supply of nerve force is required, and a waste of tissue occurs proportioned to the amount of material acted upon.

In simple transudation this is not the case. It takes place as readily through a dead membrane as through a living one, provided only that the other physical conditions are the same. No energy is expended, no tissue-change is involved. Hence, as the process is not one of functional activity, its cessation cannot be considered as functional rest.

We may conclude, therefore, that we should gain nothing for a diseased kidney by draining off pure water from the system by some other channel, and in this way diminishing the bulk of the urine excreted. On the contrary, this course would tend to embarrass the true function of the kidney by interfering with nature's provision for the removal from the interior of the tubules of the solid matter excreted by the renal cells.

This conclusion, to which we are led by *à priori* reasoning, is confirmed by clinical experience. We find in practice that a free use of water never irritates an inflamed kidney, but, on the contrary, by washing out the tubules, it tends to relieve obstruction, and thus indirectly increases the amount of solid material eliminated.

As a corollary to this, it is noteworthy that the common experience of the profession in the use of mineral waters, so-called, in chronic nephritis, has led empirically to a preference for those which contain the smallest percentage of mineral substances. Many American springs furnish water almost as pure as if distilled, and it is precisely these that are most valued in kidney affections. Among these may be mentioned the Gettysburg water, which contains only two and a half grains of solid matter to the pint, and Clysmic water, in which the proportion of solid material is still less.

These waters doubtless act simply as diluents, and their special value consists in the absence in great part of the usual impurities found in drinking water. Indeed, there is a very general impression that there is a distinct gain for the kidneys in avoiding the ingestion of the mineral substances commonly found in the water furnished by wells

and streams. Waters rendered hard by the presence of lime are considered especially unsuited to the use of those whose kidneys are easily irritated. Whether this view, as a whole, has any warrant in fact is perhaps open to doubt, but there can be no question as to the part played by such waters in the production of calculous affections. Probably distilled water, which, under the name of Hygeia water, is now being largely employed, would be even better than any of the waters of the class now under consideration.

In this connection grave doubts have arisen in my own mind, whether a part of the enormous increase of urinary diseases observed in the last twenty years may not be due to the immense consumption of mineral waters, both natural and artificial, for table use which has become so common. This consumption began about eighteen or twenty years ago, and soon attained vast proportions, every year adding to the amount.

Coincidently began a rapid increase in the prevalence of diseases of the urinary organs. In New York, in the twenty years from 1866 to 1886, the ratio of deaths from urinary diseases to deaths from all causes increased nearly twofold. In England, where the use of mineral waters as beverages is much less common than in this country, the ratio of deaths from renal disease to the total mortality is far lower than here. Thus, in London, in 1887, the ratio of deaths from urinary disease to the deaths from all causes was two and a half per cent., while in New York, in 1880, the latest date for which I have the statistics, the ratio was 5.05. It may be a simple coincidence, but it is, nevertheless, true that in 1866, before mineral waters came into general use in this country, the ratio in New York was three per cent., not far from that of London at the present time.

Certainly the use of alcohol, one of the great factors in the production of renal disease, is quite as prevalent in London as in New York. Destitution, also, with its consequent exposure, is more common there than here.

While doubtless there are many other factors concerned in this increase, at least it seems not improbable that the habitual ingestion of large amounts of the various salts contained in mineral waters may have had a considerable share in the result. Certainly the condition in which the kidneys are called upon to eliminate a greatly increased amount of inorganic material, cannot be considered normal or physiological. The constant passing of this increased proportion through the kidneys might well be a source of chronic irritation, leading at last to

change of structure. At least, in concurrence with other predisposing causes, it is conceivable that it could lead to organic disease.

But short of this, there is reason to regard it as a source of functional disturbance. Experiments have shown that substances are eliminated by the kidneys in the order of their diffusibility—that is to say, the more diffusible substances are eliminated first, the less diffusible taking their turn afterward. Hence, the presence in the blood of a highly diffusible substance is a direct hindrance to the elimination of a substance less diffusible. Now, the salts of the alkalies, and especially the binary or haloid salts, possess to a marked degree the property of diffusibility. This is especially true of the compounds of potassium and sodium, substances which are present in large quantity in most of the stronger mineral waters. So long as they are present in excess in the blood, they thrust back, as it were, the less diffusible organic compounds from the portals of exit. Present a kidney already unequal to the full performance of its depurative function, and the precedence asserted by this class of salts must result—if they be in excess—in more or less retention of other excrementitious material in the circulating fluid.

From these considerations it results that the stronger saline and alkaline waters should not be employed in renal disease; even the use of such waters as purgatives is contra-indicated.

An exception to this rule, perhaps, exists where we have contracted kidney in a gouty subject. Here the kidney affection is probably secondary, and its treatment falls in, to some extent, with that of the diathesis. Alkaline waters may therefore be of use.

But in the selection of the alkali we should choose that of which the smallest quantity will neutralize a given quantity of acid. In this selection we shall derive much help from the study of the atomic weights, which are in inverse ratio to the neutralizing power. Thus, the amount of acid which will be neutralized by forty grains of potassium, will require only twenty-four grains of magnesium, or twenty-three grains of sodium, or seven grains of lithium for neutralization, these being in round numbers the combining weights of the several bases.

It is chiefly the remarkably low atomic weight of lithium which renders this substance the most valuable of all our anti-lithics, and accounts for the beneficial effects of waters containing only a very small percentage of it. It forms with lithic acid a very soluble salt, which is easily eliminated by the kidneys, and the quantity required

to effect this is so small as not to derange digestion or to interfere with any other of the functions of the body.

In none of the mineral waters of the United States is the quantity of lithium considerable. But it is noteworthy that the lithia waters contain but a comparatively small quantity of other salts. Hence, whatever good is effected by the lithia, is not offset by the irritation which would be caused by the passage of large quantities of salts through the kidney, nor is the elimination of effete material held back while such inorganic substances are being thrown out of the system. Thus, we have the advantage derived from the waters distinguished for the absence of saline ingredients combined with the relatively great neutralizing power of the lithia.

The alkaline waters, which derive their properties chiefly from the presence of carbonates, and especially the sodium carbonate, are, of course, useful in cases of abnormally acid urine. The Saratoga Vichy is the type of American waters of this class. They are useful in proportion as the carbonates are in excess of the more stable salts. The presence of sulphates, chlorides, etc., adds nothing to the efficiency of the water. They are eliminated unchanged, and serve no other purpose than to add to the labor of the kidneys, or even perhaps to act as direct irritants.

In view of the extreme anæmia which, sooner or later, characterizes those forms of nephritis in which there is marked loss of albumin, the use of iron forms a leading indication. This indication may sometimes be fulfilled most admirably by means of the chalybeate waters. I think there can be no doubt that iron in this form often is more readily assimilated than when employed as a pharmaceutical preparation. Even in the early stage of these forms of Bright's disease, before the loss of corpuscles becomes obvious, we are warranted in anticipating the inevitable anæmia, and it is wise to adopt measures which are thus prophylactic rather than curative.

But here, again, in the choice of the water, we should beware of handicapping our remedy by associating with it an undue amount of worthless if not pernicious mineral constituents. A water otherwise nearly pure, but containing a small proportion of iron, may serve the double purpose of washing out the kidneys without irritating them, and of supplying to the blood the daily loss of iron. Such is the water furnished, for example, by the Sparta spring, in Wisconsin, which contains only 2.9 grains of solid matter to the pint, more than half of which is carbonate of iron, or the Rawley springs, in Virginia,

the water of which contains only 0.64 grain of solid material, one-third of which is carbonate of iron.

Waters containing sulphur, besides producing more or less of an alterative effect, have a tendency to stimulate the action of the skin. In cases in which the principal indication is to promote depuration, this property of the sulphur waters may sometimes be utilized. Occasionally we see patients who, having passed a short time at Richfield, or Sharon, or at one of the Virginia springs, come back with their headache, nausea, hebetude, etc., much relieved; indeed, they seem for a time to be quite made over. Doubtless, the hot baths, which are generally employed freely, are the principal factors in the result, but the action of the sulphur as a diaphoretic and depurative is not to be ignored.

In very chronic cases of nephritis, in which the patient can scarcely be made to appreciate the fact that the kidneys are not doing their full work, it is often difficult to secure the observance of the regimen prescribed by the physician. Under such circumstances, the selection each summer of a resort at a sulphur spring may enable us to secure for a portion of each year a beneficial influence not to be obtained elsewhere, and which will cost the patient nothing more than a certain monotony in the character of his summer recreation.

In regard to the use of mineral waters in joint-affections, surgical diseases of the joints will, of course, not be considered. This narrows our subject practically to their use in rheumatic and gouty arthritis.

Probably in no other class of diseases have mineral waters been so extensively and so successfully employed as in this. Nearly every chronic case, sooner or later, is subjected to this form of treatment. The selection of the water is for the most part empirical, and it cannot be denied that the effect is often different, not only in degree, but in kind, from that obtained from the use of the several ingredients which are found by analysis to exist in the water employed. Hence, the results of analysis cannot be depended upon to determine in advance the value of a particular spring. Still, in general terms, it may be stated that the alkaline and sulphur waters principally are useful in these affections. This corresponds, on the one hand, with the known value of the alkalies administered directly in rheumatism and gout, and, on the other, with the recognized efficacy of sulphur as an eliminant and alterative.

It is probably only the carbonates of the alkalies and alkaline earths that are capable of such changes as will make their bases available for combination with the organic acids present in the affected tissues.

The more stable combinations, such as the sulphates, nitrates, and chlorides, are not readily broken up, and appear, for the most part, in the urine unchanged. But it would not be entirely safe to assert, therefore, that they possess no remedial value. We have ample proof that they come into most intimate relation with every tissue of the body; and it is highly probable that they exert an important influence upon metabolism. But this action is, at best, an ill-defined and uncertain one. The carbonates, on the other hand, readily give up their bases to the organic acids present in the blood, and by neutralizing them deprive them of their hurtful properties, and at the same time favor their elimination.

Perhaps no other springs in Europe are so celebrated as those at Vichy for the cure of gout, and the Grande Grille water especially illustrates exceedingly well what I have just said as to the superior value of the carbonates. A pint of this water contains thirty-nine grains of solid matter, of which thirty-two grains are in the form of carbonates.

But in this country the springs which are most celebrated in the treatment of rheumatism and gout are thermal springs. As a rule, the quantity of solids in these waters is very small, and there is reason to believe that the temperature alone is the therapeutic agent. Probably water artificially heated, if employed with as much freedom and regularity, and with the other conditions similar, would give equally good results.

It is also to be borne in mind, that at most of these springs very active internal medication is added to the treatment. Especially at the Hot Springs, in Arkansas, is this the case. It is notorious that the cases most benefited here are those which have a syphilitic basis. These are uniformly treated by the local physicians with liberal doses of mercurials and of the iodides. It is true that many such cases are relieved here which have resisted similar internal treatment elsewhere, but it is easily conceivable that the regular and frequent use of the hot baths should aid in disseminating the drugs through the system, and thus add to their efficacy, while at the same time they increase the elimination of diseased or excrementitious material.

In the rheumatic and gouty diathesis, so much depends upon hygienic influences in promoting healthy change of tissue, that no aid in that direction should be disregarded. Such influences can be, and usually are, embodied in a large degree in the regimen of the patients at these health resorts, and to them much of the benefit obtained is unquestionably due. Removed from the cares of home

and of business, and surrendering themselves wholly to the idea of regaining health, patients will readily submit to hygienic regulations which they would disregard entirely under the conditions of their ordinary life. Hence, we may calculate upon the perfection and degree of these influences in estimating the value of any particular spring, quite as legitimately as upon the special qualities of the water, and not infrequently the value of a resort will change entirely with a change of the management.

Résumé.—The so-called mineral waters, except the chalybeate and sulphur waters, are useful in nephritis, acute or chronic, principally as diluents, and for this purpose those containing the smallest percentage of solid matter are the most valuable.

Chalybeate waters as such are valuable, not for any action upon the kidneys, but to combat or prevent the anæmia generally present in advanced cases.

Sulphur waters are valuable in some degree in chronic cases in which it is desirable to increase the elimination by the skin.

In functional derangements accompanied by undue acidity of the urine, the alkaline waters are often of much service, and those should be selected which contain the largest relative proportion of the carbonates.

It is not improbable that the habit of using as beverages large quantities of waters heavily charged with mineral substances, tends in the end to excite renal disease.

In rheumatism and gout the alkaline waters, and especially those containing lithia, are often very serviceable. Sulphur waters also are beneficial in this class of affections. The thermal waters are of use for bathing purposes, but there is no satisfactory evidence that plain water artificially heated would not under like conditions afford equally good results.

THE THERAPEUTIC VALUE OF SOME OF THE MINERAL WATERS OF THE UNITED STATES UPON MALARIAL DISEASES;

WITH RULES FOR THEIR USE.

By W. C. VAN BIBBER, M.D.,
OF BALTIMORE.

The effect of bad air upon the human system is shown in various ways, the differences depending upon the particular kinds of air which cause the diseased conditions. Salubrious situations on the earth are known and recognized mainly from certain characteristics of the human inhabitants. It is true that other air-breathing animals are injuriously affected by bad air, but this comparative study is not within the scope of the present paper.

Many of the changes in health and grades in constitution produced by climate upon man are well known, and those peculiarities of disease existing in the inhabitants of different atmospheric planes have not escaped observation. The practising physician and climatologist will do well to study the effects of hills and mountains upon the human organism, for they exercise influences not to be accounted for by the chemical analysis of the air. By far the greatest number, as well as the most serious diseases, produced by the quality of the air alone, are found to originate in the lower strata of the air—that is, at an elevation but little above the level of the sea. It is true most of the inhabitants of the earth live in these lower strata, because most of the great cities of the world are built upon navigable waters, and the most fertile lands are found in alluvial formations.

It is believed that the plane of the atmosphere 350 feet above tide water is, for the most part, free from that mysterious something which produces ague and fever. A few noteworthy exceptions may be found to this law, but the planes of the atmosphere, from tide level to a height of ten thousand feet, have already been studied as to the production of certain diseases, and the curing of others, and the work is still going on. This is one of the chief problems of the science of climatology, and one result of these observations shows that certain symptoms and individual appearances, accompanied by constant pathological changes,

are found with us, only as a rule, upon the ocean slopes and large river bottoms, and all seem to be identified with this particular atmospheric plane.

To state the matter more precisely, we may say that, if a thousand men should be selected and taken from our sea-board swamps and river bottoms, below the thirtieth parallel of latitude, and placed side by side with a thousand men selected from a plane of the atmosphere over 350 feet above tide water, north of the thirtieth parallel of latitude, the one set of men can be distinguished from the other set by the practising physician, both whilst the men are living as well as by an examination of the organs of the cadavers. Again, it is believed that, should the men from the hills and those from the swamps change abodes for a few years, corresponding changes would take place in their physical peculiarities and outward appearance. These peculiar individual changes are wrought in a gradual manner by time, and, until recently, it seemed to be by an undetected hand; yet the changes are none the less certain and well marked.

It is the changes which will take place in the thousand men transferred from the hills to the swamps which will now engage our attention. These changes steal along in the human system, for a time possibly without noticeable manifestation, until, finally, a culmination takes place, and a chill, a fever and a sweat, ensue in their proper courses. Then what was latent before soon becomes active, and the marked individual appearances begin to manifest themselves. These are, externally, a sallow and stretched skin; muddy-colored conjunctivæ, dry hair, dry and brittle nails, emaciation, a stooped, curved, and shrunken figure, and a slow crumbling of the teeth. The peculiar sensations or feelings which accompany these external appearances, are a gradual loss of strength and vigor, a desire to recline and rest, torpor of mind as well as of body. As mental effects we notice loss of ambition, indecision, procrastination, superstition, a craving for stimulants, with a continuous belief in "biliousness." These symptoms come on slowly, and may continue for years without relief, because they seldom, or never, of themselves produce death, though their effects are serious and far-reaching; and, as will be seen hereafter, the three largest and most important organs of the body are so altered in texture and function that there is, comparatively speaking, but little of the physiological man left. It is no wonder, therefore, that there should exist under these circumstances a predisposition to pneumonia or other fatal affection. So that, when from some intercurrent disease, or from accident, death does ensue, the liver is found enlarged, generally softened, but

sometimes indurated, and always changed in color, being filled with a black substance, called "pigment. The spleen is likewise enlarged, softened, and changed in color. The marrow of the bones is also altered in color and consistence; and a peculiar crescent-shaped micro-organism has been found in, and around the red blood-corpuscles which is thus described, in a letter to me by Surgeon George H. Sternberg, U. S. A. He says:

"In response to your questions I would say that the parasite discovered by Laveran in the blood of malarial fever patients presents itself in various forms. Some in the interior of the red corpuscles, amœboid and segmenting forms, and some free in the serum, crescentic and flagellate forms. That these forms represent different stages in the life-history of the same micro-organism is inferred from the fact that pigment granules are found in all of them, and also from their association in the blood of malarial fever patients, and from the fact that they have not been observed under other circumstances.

"These facts also give strong support to the view, that the parasite in question bears an etiological relation to malarial manifestations. The rapid destruction of red corpuscles during a malarial paroxysm, and the accumulations of dark pigment granules derived from the blood, especially in the liver and spleen, as the result of repeated attacks, is quite in accord with the observations of Laveran, Richard, Marchiafava, Celli, Golgi, Councilman, Osler, and others, relating to this interesting hæmatozoon."

The disease now under consideration was anciently called malaria, because it was universally believed to be due to unwholesome air. At present there is a question whether it comes into the system from the air, or through the water, in those situations where it is found; but there can be no question as to the identity of the affection; and this is the disease which will be considered in this paper.

It is surely a high office for the physician to study additional means of relief for those piteous sufferers from this terrible malady, and no more useful aim can engage the attention of this Society than to unite, in its collected wisdom, during this discussion, in an endeavor to ameliorate suffering such as is familiar to you all. The most important advance in this direction was the introduction into Europe of the cinchona bark about the middle of the seventeenth century, and its properties as a febrifuge were soon widely recognized. Numerous theories have been advanced as to the mode of operation of this remarkable remedy, and still the problem remains unsolved; perhaps only to find a solution when we shall thoroughly understand the diseased conditions for the relief of which it is employed. Three things we may take as definitely settled, viz., that the "Jesuits' powder" is beneficial in these

fevers; that it does not always cure them; and that we neither know why it succeeds nor why it fails. The immense number now suffering from both the acute and chronic forms of this kind of malaria, notwithstanding the most liberal use of the specific remedy, is sufficient to prove conclusively that it has not an absolutely curative effect by itself.

The purpose of this paper is to suggest certain supplementary or auxiliary remedial agents in the treatment of these diseases; and such remedies may be found among the mineral waters of the United States. For more than eighty years the waters of the Greenbrier White Sulphur Springs, in Greenbrier County, Virginia, have had a high reputation for the cure of malarial diseases. The situation of the spring is in a beautiful mountain valley, 1200 feet above tide level. The medicinal virtue of the water is supposed to reside both in its solid and gaseous contents. Bad cases of the kind of malaria which has been described, are to be found visiting this spring every summer for the benefit of its water; and a large proportion of these patients come from the rice and cotton plantations of the seaboard; some from the valley of the Mississippi River and its tributaries; and others from the valleys of the rivers which empty into the Gulf of Mexico. I first visited this spring as a physician in 1851. Since that time I have had opportunities to study and observe the effect of this water upon the kind of malaria which has been described; and my observations have led me to adopt a regular system for its use.

The plans of cure which I shall recommend have been tested upon many patients, and with generally good results. It often happens that those wishing to be benefited cannot remain at the spring longer than from two to four weeks; and to suit this necessity the plans have been called the two weeks' and the four weeks' plans.

That for two weeks consists in drinking as much of the water early in the morning as is necessary to sensibly affect both the bowels and the kidneys—enough to give one or two loose watery movements from the bowels, and a free discharge from the kidneys. For this purpose an average person will require from two to four glasses of the water early in the morning. These should be taken whilst the patient is in active exercise in the open air, and two hours should elapse after drinking the last glass of water before taking breakfast. At noon take a warm bath of the sulphur water, temperature 94° to 98° F., and remain in the bath from fifteen to twenty minutes. Whilst in the bath drink two or three glasses of the sulphur water. The time of the bath should be arranged so as to have dinner or lunch soon after

leaving it, say about two o'clock, which is the usual dinner-hour at the hotel. After this drink two glasses of the water at five o'clock P. M., and two before retiring at night. Wash in the sulphur water morning and night, and exercise freely during the day by walking in the mountains. This two weeks' systematic course has such a decided alterative action that few persons can safely carry it further than the time specified.

In the four weeks' course the bath is ordered every other day, and the amount of the water to be taken may be proportionally moderated. The four weeks' course should always be preferred when time can be given for this purpose. The object of this treatment is to produce a continuous acceleration in the action of both bowels and kidneys, and to increase the activity of the skin. These three objects are undoubtedly accomplished, and during the active course of treatment a good indication of its future success is found in the increased appetite, improved vigor, elevation of spirits, with a feeling of lightness of the body and buoyancy of mind, which are most agreeable. One of the peculiarities of this water, when drank pure from the fountain, is to elevate the spirits with a sensation not unlike that produced by champagne. It causes a slight feeling of dizziness and an excitement of the brain. It may be this which gives a charm to the place, and a lustre to the ball-room, which is not seen elsewhere. But it should always be used with reference to individual idiosyncrasies, either pure from the fountain, or "staled" by the evaporation of its gas according to the valuable rules given by Dr. J. J. Moorman, who was for more than thirty-five years the resident physician at this spring.

The other springs, with the waters of which I have had nearly as long an experience in chronic malarial troubles, are the Saratoga Springs, in Saratoga County, New York. There are now more than twenty-one springs opened at this celebrated place, each one of which has a different chemical analysis. My observations have been more particularly confined to the Congress, the Hathorn, the Hambleton and Washington Springs as drinking waters, and to the Putnam, the White Sulphur, and the Red Springs as bathing and washing waters. From these I have made up a definite course of treatment, which I advise for two weeks and four weeks, similarly to the courses already given for the Greenbrier White Sulphur water, and which, I think, has many advantages.

During the first week of the two weeks' course, as much of the water of the Congress Springs should be taken early in the morning, combined with active exercise, as will produce a decided effect upon the

bowels and kidneys. An average person will require from two to four glasses of this water, and the last glass should be taken about an hour and a half before breakfast. During the second week of this course the Hathorn Spring should be used. Take each day at noon a bath of the Putnam or White Sulphur water, at a temperature of 94° to 98° F., and remain in the bath from fifteen to twenty minutes, drinking whilst in the bath one or two pints of the Hambleton Spring water. At 5 o'clock P. M. take a wineglassful of the Washington Spring water—not more, and at 6 and 10 o'clock P. M. take one or two glasses from the Congress or Hathorn Spring. Wash night and morning in the water of the Red Spring.

This gives a definite course of treatment, the object of which is to produce an alterative effect, and to change rapidly the molecular structure of the body. Few individuals can continue such a course of these waters for a longer period than two weeks. In the four weeks' course, which is always to be preferred, if it is possible, the bath is to be taken every other day, and the amount of the waters taken each day to be proportionally diminished.

In this course of treatment, by the water of either of these springs, the activities of the body are increased in every department, the bowels, kidneys, skin, liver, stomach, mind, and spirits are all safely and agreeably stimulated. It is a full occupation of his time for a patient to undergo this treatment. To most persons it is a delight to experience the sensations resulting from it. The entire body seems to be renewed, and the patient feels confident that the change will be lasting. It is a safe treatment, it is systematized, and may be changed to suit individual cases. If this system is carried out, it may be of service in preventing that blind bathing and drinking which our physicians find so injurious at all the springs in this country, and which is in strong contrast with the practice at similar health resorts in Europe.

Having pointed out two springs which are salutary in malarial troubles, and having given those rules for the use of their waters which I have found most beneficial, I might here let tne subject rest; but the disease of which we are treating is such a remarkable one, its literature is so large, its prevalence so widespread, its theories so interesting, that I trust I may be permitted, in conclusion, to say a few words concerning the *modus operandi*, or the manner by which the beneficial effects of the proposed system are produced.

Until about eight years ago everything concerning the cause of intermittent or remittent fever was clouded in obscurity; and everything concerning the manner of its cure was a matter of theory and conjecture. Now a step has been taken in advance which will increase the

interest attached to its treatment. Students in Europe, at the Johns Hopkins University, in Philadelphia, and elsewhere in this country, have made public the results of study and experiment, which bring the whole subject into a new phase; replace fancies by facts, and introduce a new method of treatment. To bring this out clearly, I will place side by side the two explanations of the manner of cure, in order to contrast the old teaching with the new:

The old explanation.

"By the use of the waters, as advised, all the outlets of the body have been opened, and in this way the diseased particles have been removed. What particular path they took to get out of the system is a matter of conjecture; but the result of the treatment is sufficient to prove the fact that they were eliminated by some means or other."

The new demonstration would read in this way.

"The hæmatozoon, which controls the disease, has been found; and a study of its movements will alone reveal the truth. The number of red blood-corpuscles which have been damaged in any particular case can be told by actual count; and the restoration of healthy red blood-corpuscles can be determined in the same way. Under certain favorable circumstances, as at the springs mentioned, the healthy red blood-corpuscles are rapidly formed, and when they are sufficiently abundant and vigorous they dominate the system, resisting both the reception and the encroachments of disease. Those globules which were formed at the two springs, both of which are situated at elevations above the usual melanæmic line, were produced under different and favorable circumstances of air, food, and water. If, during a certain system of treatment, the blood be rapidly brought from a condition of disease to one of comparative health, we may legitimately infer that those globules which have been formed in the progress of the treatment, are of a healthy character; and if we were able before, to detect special vitiation in the red corpuscles, we may expect to find special improvement in these. And this is precisely the result which follows the treatment I am recommending."

Without entering any further into technical detail, I think what has been said represents the present state of our knowledge concerning paludal malaria. The plans which have been advised for its adjuvant treatment, I can recommend to you after an ample experience, and if they should be sanctioned by your reason and used in your practice, I cannot doubt that the benefits will, at least, be equal to what I have mentioned as the result of my own experience.

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